MI/EGLE/WRD-19/008

WATER QUALITY AND POLLUTION CONTROL IN MICHIGAN 2018 SECTIONS 303(d), 305(b), AND 314 INTEGRATED REPORT

Michigan Department of Environment, Great Lakes, and Energy
Water Resources Division
November 2019

This Integrated Report is available electronically on the Michigan Department of Environment, Great Lakes, and Energy (EGLE), Water Resources Division, Web site at http://www.michigan.gov/water under Lakes & Streams, Surface Water, Assessment of Michigan Waters, Water Quality and Pollution Control in Michigan Sections 303(d), 305(b), and 314 Integrated Report.

ACKNOWLEDGEMENTS

Great appreciation is extended to contributing staff members of various EGLE divisions and the Great Lakes Environmental Center for their hard work and assistance in the development of this Integrated Report.

Chapter heading images for Chapters 3 and 8 were provided by David Kenyon, Michigan Department of Natural Resources. The Chapter heading image for Chapter 1 was provided by Dawn Roush, EGLE. Chapter heading images for Chapters 5 and 7 were provided by William Taft, EGLE. The Chapter heading image for Chapter 6 was provided by Seth Wright, EGLE. Chapter heading images for Chapters 4 and 10 were provided by Matthew Wesener, EGLE. The title page image and Chapter heading images for Chapters 2 and 9 were provided by Kevin Goodwin, EGLE.

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LIST OF ACRONYMS

AIS	Aquatic Invasive Species
ATTAINS	Assessment, Total Maximum Daily Load Tracking and Implementation System
BCC	Bioaccumulative Chemicals of Concern
BPJ	Best Professional Judgment
CAZ	Critical Assessment Zone
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
EGLE	Michigan Department of Environment, Great Lakes, and Energy
GIS	Geographic Information System
HCV	Human Cancer Value
HNV	Human Noncancer Value
HUC	Hydrologic Unit Codes
IR	Integrated Report
LHD	Local Health Department
MCL	Maximum Contaminant Level
MDARD	Michigan Department of Agriculture & Rural Development
MDHHS	Michigan Department of Health and Human Services
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
NHD	National Hydrography Dataset
ng/L	Nanograms per liter
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NREPA	Natural Resources and Environmental Protection Act
P51	Procedure 51
PBB	Polybrominated Biphenyl
PCB	Polychlorinated Biphenyl
PFAS	Per- and polyfluoroalkyl substances
PFOS	Perflourooctane Sulfonate
TMDL	Total Maximum Daily Load
TSI	Trophic Status Index
USEPA	United States Environmental Protection Agency
ug/L	Micrograms per liter
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCMP	Water Chemistry Monitoring Program
WQS	Water Quality Standards
WRD	Water Resources Division

EXECUTIVE SUMMARY

The federal Water Pollution Control Act (PL 92-500), also known as the Clean Water Act (CWA), requires states to provide the United States Environmental Protection Agency (USEPA) with an assessment of the quality of their waters (Section 305[b]), a list of waters that do not support their designated uses or attain Water Quality Standards (WQS) and require the development of Total Maximum Daily Loads (TMDLs) (Section 303[d]), and an assessment of status and trends of publicly owned lakes (Section 314). Similar to the 2016 reporting cycle, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) (formerly the Michigan Department of Environmental Quality [MDEQ]) is fulfilling these CWA reporting requirements in 2018 through the submission of an Integrated Report (IR).

A primary objective of this IR is to describe attainment status of Michigan's surface waters relative to the designated uses specified in Michigan's WQS. Michigan's WQS are consistent with the Great Lakes Initiative, establish minimum water quality requirements by which the waters of the state are to be managed, and provide the primary framework that guides EGLE's water quality monitoring/assessment and water protection activities. To describe the attainment status of surface waters, each water body is placed in at least one of five reporting categories based upon the amount of information known about the water body's water quality status, the degree of designated use support, and the type of impairment preventing designated use support.

This IR includes a description of the scope of Michigan waters covered; an overview of water quality monitoring in Michigan; a description of Michigan's current assessment methodology; brief summaries of monitoring results and designated use support in the Great Lakes (including connecting channels and bays), inland lakes and reservoirs, rivers, and wetlands; information regarding water bodies not supporting designated uses, including water bodies requiring the development of a TMDL (i.e., Section 303[d] listings); and a summary of the public participation process used in the development of this IR.

With the biennial development of each IR, Michigan continues to refine its data management and assessment methodology. This 2018 IR saw a complete migration of Michigan's assessment data from the Assessment Database, formerly developed but no longer supported by the USEPA, into a newly redesigned national database. The USEPA-developed Assessment, Total Maximum Daily Load Tracking and Implementation System (ATTAINS) was created as the singular location for assessment decision storage and output nationwide to be implemented for the 2018 IR cycle by all states and tribes.

The significant redesign of this online database was met with delays at the national level, which had subsequent impacts on Michigan's timing in producing their 2018 IR. However, the long-term benefits of increased data continuity, tracking, access, and the ability to more transparently display and give public access has been a powerful argument for this development. ATTAINS Web access, when paired with the upcoming release of the redesigned "Hows My Waterway" Web site (anticipated Fall 2019) will give broad access to the nation's water quality information at many scales and assessment decisions in a more user-friendly platform geared toward the lay-person, but with access to information and data that technical experts will also find helpful. As such, use of past resources such as the Michigan Surface Water Information Management System (MiSWIMS) to display similar information will be discontinued. Availability of online access to Geographic Information System (GIS) data is planned for this 2018 IR cycle as well.

Detailed lists of designated use support are contained in this report (Appendix B). Broadly, many of Michigan's surface waters continue to be impacted by polychlorinated biphenyls (PCB) and mercury and consequently do not support the other indigenous aquatic life and wildlife

designated use and/or the fish consumption designated use. Atmospheric deposition is considered to be the major source of these persistent bioaccumulative chemicals. Additionally, Per- and polyfluoroalkyl substances (PFAS) comprise an emerging group of contaminants that may have broad impacts on water quality. The recent significant expansion in PFAS monitoring in Michigan (data collected in 2017 and beyond) was not considered within the timeframe of this 2018 IR; recent PFAS data will be a focus of future assessments and reports starting with the 2020 IR as they are received, quality checked, and assessed. Excluding PCBs and mercury, physical/chemical and biological assessments of inland lakes and rivers indicate designated uses are supported in a majority of water bodies.

CHAPTER 1
INTRODUCTION

1.1 Purpose

The federal Water Pollution Control Act (PL 92-500), also known as the CWA, requires states to provide the USEPA with an assessment of the quality of their waters (Section 305[b]), a list of waters that do not support their designated uses or attain WQS and require the development of TMDLs (Section 303[d]), and an assessment of status and trends of publicly owned lakes (Section 314). Similar to the 2016 reporting cycle, EGLE is fulfilling these CWA reporting requirements in 2018 through the submission of an IR. Where possible, Michigan's 2018 IR was developed consistent with the USEPA's "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b), and 314 of the Clean Water Act" and supplemental guidance information for 2008-2018 IRs prepared by the USEPA.

A primary objective of this IR is to describe attainment status of Michigan's surface waters relative to the designated uses specified in Michigan's WQS (available at https://www.michigan.gov/documents/deq/wrd-rules-part4_521508_7.pdf). Michigan's Part 4 Rules, WQS, are promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). Michigan's WQS are consistent with the Great Lakes Initiative, establish minimum water quality requirements by which the waters of the state are to be managed, and provide the primary regulatory framework that guides EGLE's water quality monitoring/assessment and water protection activities. To describe the attainment status of surface waters, each water body is placed in at least one of five reporting categories (see Section 4.11) based upon the amount of information known about the water body's water quality status, the degree of designated use support, and the type of impairment preventing designated use support. Additionally, the attainment status information described within this IR is used to help inform some of the outcomes associated with various goals identified within the Water Resources Division's (WRD) Measures of Success. The Measures of Success are used to define the expected outcomes of water resource programs geared toward having clean and safe water (http://www.michigan.gov/deq/0,1607,7-135-3306_28610---,00.html).

Similar to previous IRs, trends in designated use support are not discussed in this IR. Due to data management changes over time, and assessment methodology changes cycle-to-cycle, designated use support summaries are not directly comparable to previous IRs. Analysis of designated use support trends based on information presented in this and previous reports (e.g., change in number of river miles supporting designated uses) would be misleading. As assessment coverage increases and water bodies are evaluated for the first time or when more sophisticated and sensitive monitoring techniques are applied (e.g., low level PCB analysis), the proportion of supporting versus not supporting water bodies will change between reporting cycles. However, such a proportion change between reporting cycles often may not constitute a real overall change in water quality but rather an increased accuracy in the ability to assess and account for designated use conditions.

The remainder of this chapter includes a description of the scope of Michigan waters covered in this IR. Chapter 3 contains an overview of water quality monitoring in Michigan. Chapter 4 details Michigan's current assessment methodology. Chapters 4, 5, 6, and 7 provide summaries of monitoring results and designated use support in the Great Lakes (including connecting channels and bays), inland lakes, rivers, and wetlands, respectively. Chapter 8 addresses all water body types not supporting designated uses, including water bodies requiring the development of a TMDL [i.e., Section 303(d) listings]. Chapter 9 includes information regarding the public participation process in the development of this IR.

Data Management and Output Updates

This 2018 IR cycle brings significant changes to how information related to assessment decisions are recorded, stored, and communicated. This change by USEPA is intended to ultimately provide greater public access to information, more efficient data transfer between the state and the USEPA, and overall a more consistent manner for states and authorized tribes to store, exchange, and retain assessment information. This 2018 IR saw a complete migration of Michigan's assessment data from the Assessment Database, formerly developed but no longer supported by the USEPA, into a newly redesigned national database. The USEPA-developed ATTAINS was created as the singular location for assessment decision storage and output nationwide to be implemented for the 2018 IR cycle by all states and tribes.

The process of transitioning between the two databases, however, is substantial and subject to delays. Some of those caused cascade delays in the production and submission to the USEPA of Michigan's 2018 IR, other transition delays have resulted in summary information, familiar in past IR cycles, not being readily available for this 2018 IR. It is the expectation that the 2020 IR cycle will more fully realize the benefits and output of this new system.

Importantly, the appendices which comprise the Section 305(b) and 303(d) lists are available (Appendices B and C, respectively), as are explicit lists of impairment delistings and new listings (Appendices, D1 and D2, respectively).

As in past cycles, Michigan's system uses a 12-digit hydrologic unit code (HUC)-based naming convention and the National Hydrography Dataset (NHD) to georeferenced records. This same naming system continues to be used in the USEPA's newly redesigned ATTAINS online database.

1.2 Michigan's Waters

Michigan is blessed with a wealth of surface water resources, including Great Lakes and their connecting channels, inland lakes, rivers, and wetlands (Table 1.1). Most of Michigan also has an abundant supply of high-quality groundwater.

In general, the open waters of the Great Lakes have good to excellent water quality. The inland waters of Michigan's Upper Peninsula and the northern half of the Lower Peninsula support diverse aquatic communities and are commonly found to have good to excellent water quality. Many lakes and rivers in this mostly forested area of the state support coldwater fish populations. Lakes and rivers in the southern half of Michigan's Lower Peninsula generally have good water quality and support warmwater biological communities as well as some

coldwater fish populations. The southern portion of the state contains Michigan's major urban areas with much of the rural land in agricultural production. Many of Michigan's rivers and lakes receive direct discharge of treated effluent from municipal and industrial sources as well as runoff from urbanized areas, construction sites, and agricultural areas. Sedimentation, nutrient enrichment, and toxic pollutant loading are problems associated with runoff that can impact surface water quality. Surface water quality is generally showing improvement where programs are in place to correct problems and restore water quality.

Table 1.1 Michigan Atlas (all values are approximations).

Topic	Number	Area	Length	Source
State population	**9.9 Million**			**United States Census Bureau 2010 Estimate**
State surface area		**96,760 mi^2**		**Sommers, 1977**
Great Lakes, Great Lakes bays, and Lake St. Clair		**42,167 mi^2 (~45% of total Great Lakes area)**	**3,049 mi shoreline**	**USGS NHD (1:24,000 scale)**
Inland lakes and reservoirs with surface area ≥ 0.1 acre	**46,000**	**872,109 acres**		**USGS NHD (1:24,000 scale)**
Rivers and streams (including connecting channels)			**76,439 mi**	**USGS NHD (1:24,000 scale)**
Wetlands		**6,465,109 acres**		**USFWS National Wetland Inventory**

1.2.1 Great Lakes, Bays, Connecting Channels, and Lake St. Clair

The Great Lakes contain 20 percent of the world's fresh surface water and are a unique natural resource. The protection of the Great Lakes is shared by the United States and Canadian federal governments; the states of Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York; and the Canadian Provinces of Ontario and Quebec. Various Native American tribal organizations are also stakeholders and play a role in protecting Great Lakes water quality.

Michigan lies almost entirely within the watersheds of Lakes Superior, Michigan, Huron, and Erie (Table 1.2). The state maintains jurisdiction over approximately 45 percent (by surface area) of the 4 bordering Great Lakes (38,865 of a total area of 86,910 square miles) and 3,049 miles of Great Lakes shoreline. Significant Great Lakes bays include Grand Traverse Bay and Saginaw Bay. In this IR, the St. Marys, St. Clair, and Detroit Rivers (connecting channels) and Lake St. Clair are generally discussed in the Great Lakes Chapter (see Chapter 4). The term "connecting channels" used in this report is slightly different than the term "connecting waters" defined in Michigan's WQS. In this IR, the Keweenaw waterway (i.e., the Portage Lake ship canal, Portage Lake, Portage River, etc.) is reported as river miles and inland lakes. Michigan's WQS include the Keweenaw waterway in the "connecting waters" definition.

Generally, the open waters of the upper Great Lakes (Superior, Michigan, and Huron) have excellent water quality. Exceptions include a few impaired locations restricted to nearshore zones influenced by large, densely populated, and heavily industrialized areas. Great Lakes water quality has benefited from pollutant control and remedial efforts in tributaries. These

activities have reduced the discharge of conventional and toxic pollutants, including nutrients, persistent organic compounds, metals, and oils.

Table 1.2 Jurisdictional control of the four Great Lakes bordered by Michigan.

	Canadian* (miles^2)	United States* (miles^2)	Michigan† (miles^2)	Total* (miles^2)
Lake Superior	11,100	20,600	16,400	31,700
Lake Michigan	---	22,300	13,250	22,300
Lake Huron	13,900	9,100	9,100	23,000
Lake Erie	4,930	4,980	115	9,910
Total	29,930	56,980	38,865	86,910

*Strum, 2000; †United States Census Bureau 2002 estimate

Aquatic Invasive Species (AIS) continue to have dramatic indirect and direct effects on the Great Lakes. AIS are responsible for increases in water clarity, loss of organisms and biodiversity, disruption of food webs, and impacts on economically important fish species (International Association for Great Lakes Research, 2002). Emerging research also shows that AIS cause changes in nutrient cycling and availability and may contribute to increased plant and algae growth in many nearshore areas, such as Saginaw Bay and the western basin of Lake Erie.

The Great Lakes have problems with selected persistent bioaccumulative chemicals. Fish consumption advisories in the Great Lakes serve as reminders that certain pollutants, such as PCBs, chlordane, dioxins, and mercury remain elevated in the water column and fish tissue. The use of PCBs and dichlorodiphenyltrichloroethane (DDT) was banned in the 1970s and concentrations of these chemicals in Great Lakes fish have declined; however, concentrations in some species still require consumption advisories. Atmospheric deposition, tributary loadings, and the dynamic exchange and cycling between air, water, and sediment within the Great Lakes basins are the key factors influencing contaminant levels in Great Lakes fish.

1.2.2 Inland Lakes and Reservoirs

Michigan has approximately 46,000 inland lakes (including lakes, ponds, and river impoundments) with a surface area of at least one-tenth of an acre or greater. Lakes with the largest surface area include Houghton (Roscommon County), Torch (Antrim and Kalkaska Counties), Charlevoix (Charlevoix County), Burt (Cheboygan County), Mullett (Cheboygan County), Gogebic (Gogebic and Ontonagon Counties), Manistique (Luce and Mackinac Counties), Black (Cheboygan and Presque Isle Counties), Crystal (Benzie County), Portage (Houghton County), and Higgins (Crawford and Roscommon Counties).

Michigan has 730 inland lakes that are deemed “public access lakes” (Table 1.3). The list of public access lakes includes lakes with a public boat launch and a lake surface area of at least 50 acres as well as a few recreationally important small lakes (less than 50 acres) that have public boat launches. There are 345 public access lakes located in the southern Lower Peninsula, 219 in the northern Lower Peninsula, and 166 in the Upper Peninsula. The average public access lake size is 341 acres in the southern Lower Peninsula, 1,342 acres in the northern Lower Peninsula, and 731 acres in the Upper Peninsula.

Michigan has 156 inland lakes that are deemed “cisco lakes” (Table 1.3). The cisco (*Coregonus artedi*) is a member of a trout and salmon (Salmonidae) subfamily that usually

occupies the cooler and deeper niches of high quality freshwater inland lakes and many parts of the Great Lakes. In North America, cisco can be found from Alaska to New England. Ciscos are, or were, present in at least 156 lakes in 41 Michigan counties ranging from the Indiana border to Keweenaw County in the Upper Peninsula. The cisco is currently identified as a state threatened species pursuant to the NREPA. Ciscos require relatively deep inland lakes with cool, well-oxygenated waters. During summer stratification, cisco are rarely found in waters above 20^{o}C or at dissolved oxygen concentrations less than 3.0 parts per million. This species is very sensitive to habitat degradation and has been extirpated from lakes where these minimum thermal and dissolved oxygen conditions are not met. In 2003, the Michigan Department of Natural Resources (MDNR) initiated a study to assess the status of the cisco populations in Michigan. The intent of this ongoing study is to identify inland lakes in which populations are extant and increase awareness of this species so that protective Best Management Practices are promoted.

Table 1.3. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

ALCONA	BARRY	CALHOUN	CHIPPEWA
Alcona Dam Pond	Baker	Duck	Caribou
Brownlee	Barlow†	Goguac	Carp
Cedar	Big Cedar†	Homer	Frenchmans
Crooked	Bristol	Lane	Hulbert†
Hubbard*	Carter	Lee	Monacle*
Jewell	Chief Noonday	Nottawa	Shelldrake Impoundment
North	Clear	Prairie	
Vaughn	Cloverdale	Upper Brace	CLARE
	Crooked	Wabascon	Arnold
ALGER	Deep	Warner's	Big Long
AuTrain Basin	Duncan	Winnipeg	Budd
AuTrain Lake	Fine		Cranberry
Deer†	Fish*	CASS	Crooked
Fish	Gun	Baldwin*	Five
Grand Sable	Jordan	Belas	George
Kingston	Leach	Birch*	Lily
Nawakwa	Lime†	Bunker†	Little Long
	Little Cedar†	Chain†	Mud
ALLEGAN	Long (Hope Twp)	Christiana	Perch
Allegan	Long (Johnstown Twp)*	Curtis†	Shingle
Baseline	Long (Yankee Springs Twp)	Day†	Silver
Big	Lower Crooked	Dewey	Windover
Duck	Middle	Diamond	
Eagle	Payne	Donnell*	CLINTON
Green*	Pine	Driskels	Ovid
Hutchins	Thornapple	Fish	Park
Kalamazoo		Harwood*	
Lower Scott	BENZIE	Hemlock	CRAWFORD
Miner	Ann*	Indiana†	Jones
Osterhout	Betsie	Juno/Painter	K.P.
Selkirk	Crystal*	Kirk*	Margrethe
Swan	Herendeene	Lewis†	Section One
Swan Creek Pond	Little Platte	Lime†	Shupac
	Lower Herring	Magician	
ALPENA	Pearl	Mill	DELTA
Beaver*	Platte	North Twin	Boney Falls
Fletcher Pond	Stevens	Paradise	Camp 7
	Turtle	Round†	Corner
ANTRIM	Upper Herring	Shavehead*	Dana
Bellaire*		South Twin	Pole Creek Lake
Benway	BERRIEN	Stone	Round
Birch	Paw Paw	Tharp†	Skeels
Clam			
Elk*	BRANCH	CHARLEVOIX	DICKINSON
Ellsworth	Archer*	Charlevoix*	Antoine
Intermediate*	Bartholomew†	Deer	Bass
Lake of the Woods	Cary	Hoffman	Carney
St. Clair	Coldwater*	Six Mile	Edey
Torch*	Craig	Susan	Hamilton
Wilson	East Long*	Thumb	Louise†
	George	Walloon*	Mary*
BARAGA	Gilead		Norway
Beaufort	Kenyon	CHEBOYGAN	Pickeral
Big Keewaydin	Lavine	Black	Rock
King	Marble*	Burt*	Sawyer
Parent	Matteson	Douglas†	Silver
Prickett Dam	Morrison	Lancaster	Six Mile
Ruth	North	Long	
Vermilac	Oliverda	Mullett*	EATON
	Randall	Silver	Narrow
	Rose (Lake of the Woods)	Twin Central†	Saubee†
	Silver	Twin North†	
	South	Twin South †	
	Union		

Table 1.3 continued. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

EMMET
- Crooked
- Larks
- Paradise
- Pickeral
- Round

GENESEE
- C.S. Mott Impoundment
- Fenton
- Holloway Reservoir
- Kearsley Reservoir
- Lobdell*
- Ponemah
- Thread

GLADWIN
- Lake Four
- Pratt
- Secord Impoundment
- Wiggins
- Wixom Impoundment

GOGEBIC
- Allen
- Bass
- Beatons
- Bobcat
- Chaney
- Cisco*
- Clark*
- Clearwater
- Crooked†
- Dinner
- Duck
- Eel
- Gogebic*
- Henry Impoundment
- Lac Vieux Desert
- Loon†
- Langford
- Little Oxbow
- Lake Pomeroy
- Marion
- McDonald

GOGEBIC cont'd
- Moon
- Moosehead
- Moraine
- Noorwood†
- Ormes
- Sunday
- Taylor*
- Thousand Island*

GRAND TRAVERSE
- Arbutus
- Bass
- Bass
- Boardman
- Bridge†
- Brown Bridge Pond
- Cedar
- Cedar Hedge*
- Dubonnet
- Duck*
- Fife
- Green*
- Long
- Silver
- Spider

HILLSDALE
- Baw Beese
- Bear*
- Bird
- Carpenter†
- Cub
- Diane
- Hemlock*
- Long (Reading Twp)*
- Long (Stubin Co., IN)
- Round
- Sand North†
- Sand Middle†
- Sand South†
- Wilson†

HOUGHTON
- Bob
- Boston
- Emily
- Otter*
- Pike
- Portage*
- Rice
- Roland
- Sandy
- Torch*

INGHAM
- Lansing

IONIA
- Long
- Morrison
- Sessions
- Woodard

IOSCO
- Floyd
- Foote Dam Pond
- Indian
- Londo
- Long
- Loon*
- Loud Dam Pond
- Round
- Sand
- Tawas
- VanEtten
- West Londo

IRON
- Bass
- Brule
- Buck
- Cable
- Camp
- Chicagon
- Deer
- Ellen
- Emily
- Fire
- First Fortune
- Gibson
- Golden
- Hagerman
- Hannah Webb
- Indian
- Iron
- James
- Kidney
- Little Smoky
- Long
- Mary
- Michigamme
- Norway
- Ottawa
- Perch
- Runkle
- Smoky*
- Stager
- Stanley
- Sunset
- Swan
- Tamarack
- Tepee
- Winslow

ISABELLA
- Coldwater*
- Halls
- Littlefield*
- Stevenson

JACKSON
- Brown†
- Center
- Clark
- Crispell
- Gilletts
- Grass
- Pleasant
- Portage
- Round
- South Lime
- Swain's*
- Vandercook*
- Vineyard
- Wampler's

KALAMAZOO
- Austin
- Barton
- Crooked†
- Eagle
- Eagle
- Gourdneck
- Gull*
- Hogsett
- Howard†
- Indian*
- Long
- Morrow Pond
- Paw Paw*
- Portage (Blue)
- Ruppert
- Sagmaw†
- Sherman
- Sugarloaf
- West
- Whitford

KALKASKA
- Bear
- Blue (Big)*
- Big Guernsey
- Cub
- East
- Indian
- Manistee
- North Blue†
- Pickeral
- Starvation
- Skegmog*
- Twin (Big)*

Table 1.3 continued. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

KENT
- Bass
- Big Myers
- Big Pine Island
- Big Wabasis
- Camp
- Campau
- Campbell
- Lime
- Lincoln
- Murray*
- Pratt
- Reeds
- Ziegenfuss†

KEWEENAW
- Bailey
- Desor†
- Fanny Hoe*
- Gratiot
- Lac LaBelle
- Medora
- Ritchie†
- Sargent†
- Siskiwit†
- Thayer's

LAKE
- Big Bass
- Big Star
- Harper
- Idlewild
- Little Bass†
- Paradise
- Reed
- Wolf

LAPEER
- Big Fish
- Davidson
- Long
- Minnewanna
- Nepessing
- Otter

LEELANAU
- Cedar
- Davis
- Glen*
- Lime
- Little Glen
- Little Traverse*
- North Lk Leelanau*
- School
- South Lk Leelanau*

LENAWEE
- Allens
- Deep
- Devils
- Hudson
- Round
- Round
- Sand

LIVINGSTON
- Appleton*
- Baseline*
- Bass†
- Bennett†
- Bishop
- Chemung*
- Fish†
- East Crooked*
- Hiland
- Limekiln†
- Ore†
- Portage†
- Runyan†
- Sandy Bottom†
- Thompson
- West Crooked*
- Whitmore
- Woodland
- Zukey†

LUCE
- Bass
- Bodi
- Culhane
- Kaks
- Muskallonge
- North Manistique*
- Perch
- Pike
- Twin

MACKINAC
- Brevoort*
- Little Brevoort
- Manistique*
- Milakokia
- Millicoquins
- S. Manistique*

MACOMB
- Stony Creek Impoundment

MANISTEE
- Arcadia
- Bear
- Canfield
- Healy
- Manistee
- Pine*
- Portage

MARQUETTE
- Anderson
- Ann†
- Arfelin
- Bass
- Bass
- Big Shag
- Dead River Storage Basin
- Engmans
- Greenwood Reservoir
- Horseshoe
- Independence*
- Ives†
- Johnson
- Little
- Little Shag
- Michigamme
- McClure Storage Reservoir
- Mountain†
- Pike
- Pine†
- Rush†
- Silver†
- Sporley*
- Squaw
- Witch
- Wolf

MASON
- Bass
- Ford
- Gun
- Hackert (Crystal)
- Hamlin
- Lincoln
- Pere Marquette
- Pliness
- Round

MECOSTA
- Bergess
- Blue
- Chippewa
- Clear
- Hillsview
- Horsehead
- Jehnsen
- Martiny
- Mecosta
- Merrill
- Pretty
- Rogers Pond
- Round
- School Section
- Townline

MENOMINEE
- Long

MIDLAND
- Sanford

MISSAUKEE
- Crooked
- Goose
- Long
- Missaukee
- Sapphire

MONTCALM
- Baldwin
- Bass
- Clifford
- Cowden
- Crystal
- Derby
- Dickerson
- Halfmoon
- Horseshoe
- Little Whitefish
- Loon
- Montcalm
- Mud
- Muskellunge
- Nevins
- Rainbow
- Rock
- Tamarack
- Townline
- Whitefish
- Winfield

MONTMORENCY
- Atlanta
- Avalon*
- Avery
- Clear
- East Twin
- Ess
- Gaylanta
- Grass
- Lake Fifteen
- Long*
- McCormick
- Muskellunge
- Rush
- Sage
- West Twin

MUSKEGON
- Bear
- Big Blue
- Duck
- East Twin
- Fox
- Half-Moon
- Mona
- Muskegon
- North
- White
- Wolf

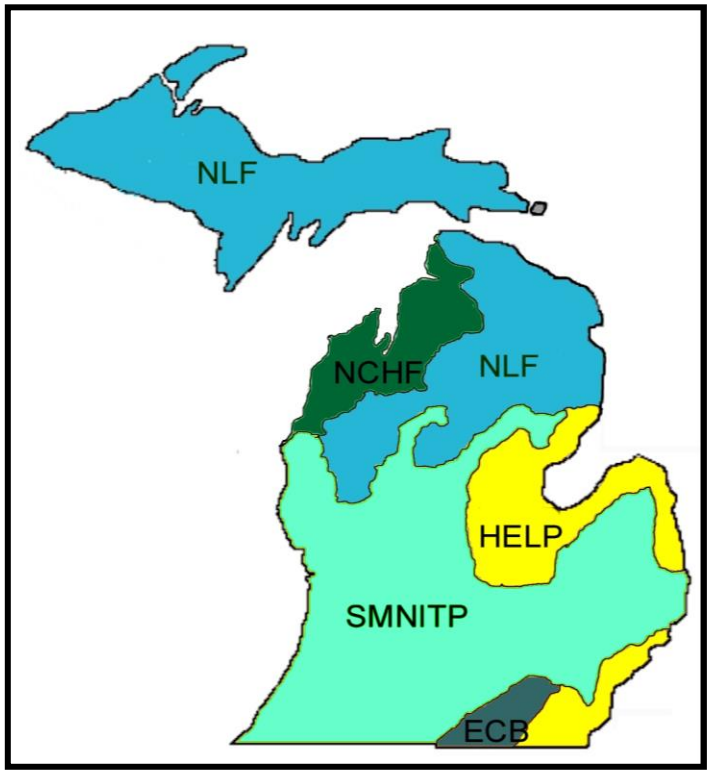
Table 1.3 continued. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

NEWAYGO	OCEANA	PRESQUE ISLE	VAN BUREN
Baptist	Crystal	Big Tomahawk	Ackley
Benton	McLaren	Emma	Banksons
Bills	Pentwater	Essau	Brandywine
Blanch	Schoolsection	Grand	Cedar
Brooks	Silver	Long	Clear
Croton Dam Pond	Stony	Lost	Cora
Crystal		May	Eagle
Diamond	OGEMAW	Nettie	Eleven
Englewright	Au Sable	Shoepac	Fish
Fremont	Bush	Sunken	Fourteen
Hardy	Clear		Gravel
Hess	DeVoe*	ROSCOMMON	Halls
Kimball*	George	Higgins*	Huzzy's
Nichols*	Grousehaven*	Houghton	Lake of the Woods
Pettibone	Hardwood	St. Helen	Maple
Pickerel*	Horseshoe		North Scott
Robinson	Lake George	SCHOOLCRAFT	Round
Sand	Peach	Boot	Rush
Woodland	Rifle	Colwell	Saddle
	Sage	Dodge	School
OAKLAND	Tee	Gemini	Section
Angelus†		Gulliver*	Shafer
Big	ONTONAGON	Indian*	South Scott
Cass*	Bond Falls	Island	Three Legged
Cedar Island*	County Line	Kennedy	Three Mile
Crescent		McDonald	Upper Jeptha
Deer*	OSCEOLA	Petes	Upper Reynolds
Dickinson	Big	Ross	VanAuken
Dunham†	Diamond	Snyder	Wolf†
Green†	Hicks		
Hammond†	Rose	ST JOSEPH	WASHTENAW
Heron	Sunrise	Big Fish	Big Portage
Kent	Todd	Clear	Blind†
Lakeville	Wells	Corey*	Bruin*
Long		Crotch	Cedar
Loon*	OSCODA	Fisher's	Crooked
Lotus*	McCollum	Klinger*	Ford
Lower Pettibone	Mio Dam	Long	Four Mile
Maceday*	Pond	Long	Green
Middle Straits	Tea	Palmer	Half Moon*
Oakland		Pleasant*	Joslin
Orchard*	OTSEGO	Portage	Mill
Orion	Big	Prairie River*	Mud
Oxbow†	Big Bass	Sand	North
Pontiac	Big Bear	Sturgeon	Pickerel†
Seven	Bradford	Tamarack†	South*
Silver†	Dixon	Thompson*	Sugar Loaf
Squaw/Clear	Emerald	Three Rivers Impoundment	Winnewanna
Tipsico	Heart		
Townsend†	Manuka	TUSCOLA	WAYNE
Union*	Opal	Caro Reservoir	Belleville
Upper Proud	Otsego	Murphy	Newburgh
Upper Pettibone†	Pickerel	North	
Valley	Twenty Seven		WEXFORD
White			Berry
Wildwood	OTTAWA		Cadillac
Wolverine	Crockery		Hodenpyl Dam Pond
	Macatawa		Long
	Pigeon		Mitchell
	Spring		

1.2.3 Rivers

Michigan's rivers can be grouped by the distinct ecoregions through which they flow. Each of the five ecoregions in Michigan consists of areas that exhibit relatively similar geological landform characteristics (Omernik and Gallant, 1988). Factors used to delineate ecoregions include climate, soils, vegetation, land slope, and land use. This framework provides information on the environmental characteristics that tend to occur within each ecoregion. In order by size (largest to smallest area), the five ecoregions in Michigan are Southern Michigan/Northern Indiana Till Plains, Northern Lakes and Forests, North Central Hardwood Forests, Huron-Erie Lake Plains, and Eastern Corn Belt Plains (Figure 1.1).

Rivers in the Northern Lakes and Forests and North Central Hardwood Forests ecoregions tend to support coldwater fish within at least a portion of their systems. These rivers commonly have relatively small watersheds, high relief topography, substantial groundwater inputs, and are naturally low in productivity. Most rivers in the Northern Lakes and Forests ecoregion are perennial, often originating from lakes or wetlands. Although relatively free of sediment, surface waters in this ecoregion often have a characteristic brownish color because of elevated concentrations of dissolved organic material, including tannins and lignins. In the North Central Hardwood Forests ecoregion, river flow is highly variable. Flow is entirely intermittent in some portions of the ecoregion and entirely perennial in other areas. These rivers typically drain soils with much poorer nutrient content than in bordering ecoregions to the south.



SMNITP - Southern Michigan/Northern Indiana Till Plains
NCHF - North Central Hardwood Forests
NLF - Northern Lakes and Forests
HELP - Huron-Erie Lake Plains
ECB - Eastern Corn Belt Plains

Figure 1.1. Ecoregions of Michigan (Level III) (adapted from Omernik and Gallant, 1988).

Rivers in the Southern Michigan/Northern Indiana Till Plains ecoregion are generally of good water quality in the headwaters. This ecoregion is drained predominantly by perennial rivers. Such rivers are typically sluggish and are bordered, often extensively, by wetland tracts. Drainage ditches and channelized rivers have been a common solution to assist drainage of areas that are too wet for settlement and agricultural needs.

Upland features related to poor soil drainage heavily influence the rivers in the Huron-Erie Lake Plains and Eastern Corn Belt Plains ecoregions. Broad and nearly level lake plain is crossed by beach ridges and low moraines, which has resulted in the formation of poorly drained soils. More than half of the rivers in the Huron-Erie Lake Plains ecoregion are intermittent, and river flows are commonly runoff-dependent. In addition to the construction of numerous drainage ditches, the headwaters of many rivers are extensively channelized for quicker drainage and to improve upland field conditions. About half of the rivers in the Eastern Corn Belt Plains ecoregion are perennial and many have been channelized to assist soil drainage. This ecoregion is almost entirely farmland, and river quality is influenced by increased soil and water runoff from agricultural land uses.

1.2.4 Wetlands

About 15 percent of Michigan's land area is wetland. Several inventories of wetlands in Michigan have been undertaken by different agencies. The two most utilized are the Part 303 State Wetland Inventory, and the United States Fish and Wildlife Service (USFWS) National Wetland Inventory. Sources of wetland loss include permitted activities; unpermitted activities (i.e., violations of Section 404 of the CWA and state law); activities that are exempt under state and federal law; the loss of small, isolated wetlands that are not under state or federal jurisdiction; natural processes (e.g., beaver activity); and indirect effects (e.g., alteration of drainage networks due to urbanization). Wetland acreage may increase for some of the same reasons (e.g., changes in drainage pathways). However, most wetland gains are attributed to voluntary wetland restoration projects, pond construction, and mitigation for permitted impacts.

Part 303, Wetlands Protection, of the NREPA requires EGLE to make a preliminary inventory of all wetlands in the state on a county-by-county basis. County wetland inventories are now completed for all 83 counties in the state, and have been made available to the public on the Internet at http://www.michigan.gov/water under Wetlands Protection, 'Are there wetlands on my property?'. The county wetland inventories were produced by overlaying data from the following sources: the USFWS National Wetland Inventory maps (1978), Natural Resources Conservation Service soil survey maps, and Michigan Resource Information System land use/land cover maps. County wetland inventories are intended to be used as planning tools that provide potential and approximate locations of wetlands and some information regarding wetland condition, but are not intended to be used to determine the jurisdictional boundaries of wetland areas subject to regulation.

Estimates of wetland losses since European settlement range from 35 percent, based on the Michigan Natural Features Inventory presettlement inventory to 50 percent based on the USFWS Status and Trends reporting. During 2006, EGLE's, Wetlands, Lakes, and Streams Unit, partnered with Ducks Unlimited Great Lakes/Atlantic Regional Office to perform an update to the original National Wetland Inventory dataset that was completed in the late 1970s and early 1980s. The project updated the National Wetland Inventory dataset to the two most recent, statewide, aerial photography flights conducted in the state, that being the 1998 United States Geological Survey (USGS) Digital Ortho Quarter Quads data and the 2005 National Agriculture Imagery Program data. This effort resulted in three distinct temporal wetland inventories for the State from which to draw conclusions and analyze trends. The 1998 inventory shows a total loss of vegetated wetlands of 32,839 acres. The 2005 inventory shows a total loss of vegetated wetlands of 8,096 acres. Subtracting these losses from the original

National Wetland Inventory total wetland acreage yields a total of 6,465,109 acres of wetland remaining in Michigan.

The Michigan Natural Features Inventory published a preliminary assessment entitled, “Wetland Trends in Michigan Since 1800” (Comer, 1996), based on a comparison of original land surveys conducted by the General Land Office from 1816 to 1856 and Michigan Resource Information System land use/land cover maps. This publication includes a county-by-county estimate of historical wetland types and losses since pre-European settlement. In addition, the pre-European settlement maps have been digitized and are available for review in a GIS.

1.2.5 Water Protection Activities

EGLE has a number of programs designed to protect and restore water quality. These programs: establish WQS; provide regulatory oversight for public water supplies; issue permits to regulate the discharge of industrial and municipal wastewaters and to alter wetlands, lakes, streams, and Great Lakes bottomlands; provide technical and financial assistance to reduce pollutant runoff; ensure compliance with state laws; regulate and protect wetlands; and educate the public about water quality issues. More information on Michigan’s water quality protection programs can be found online at https://www.michigan.gov/water.

The activities encompassing Michigan’s water quality protection programs are carried out by several EGLE divisions and offices. Full quantification of expenditures is not possible at this time. However, the WRD alone spent approximately $64.6 million in fiscal year 2017 and $63.7 million in fiscal year 2018 for the implementation of water quality protection, restoration, and monitoring programs. Sources include federal funds, state general funds, Clean Michigan Initiative state bond funds, and fees. These expenditures support EGLE staffing and operating expenses as well as grants and loans to local governments and organizations. A variety of water quality protection activities are implemented through these funds, including regulatory requirements, technical and financial assistance, and education/outreach efforts. These expenditures also leverage substantial local funds and services, since many of the programs and grants have cost-share or match requirements.

The benefits associated with the implementation of these programs are numerous, although it is not possible to accurately quantify the benefits in strictly monetary terms. From a financial perspective, citizens and out-of-state tourists are estimated to spend over $22 billion each year on Michigan tourism, much of that on outdoor sports and recreation that depend on clean water, air, and forests. Popular activities include hunting, fishing, boating, and swimming at Great Lakes and inland beaches. The revenue from these activities far exceed the money spent on water quality protection and monitoring activities each year. Aside from strictly financial considerations, clean water is also essential to protect human health, drinking water quality, biological diversity, and quality of life issues, which attract many businesses and citizens to live and work in Michigan.

CHAPTER 2
WATER QUALITY MONITORING

Environmental monitoring is an essential component of the EGLE mission. Comprehensive water quality monitoring is necessary to improve natural resource management, maintain sustainable ecosystems, and protect public health. Although EGLE is the lead state agency responsible for monitoring, assessing, and managing the state's surface water and groundwater, effective water resource management is best achieved through the formation and implementation of meaningful coalition partnerships with outside entities including other state and federal agencies, Canadian organizations, local governments, tribes, universities, industry, environmental groups, and citizen volunteers. Wherever possible, EGLE strives to organize and direct the resources and energies created by these partnerships through a "watershed approach" to protect the quality and quantity of the state's water resources.

Many EGLE water quality monitoring and water pollution control programs are integrated and implemented according to a 5-year rotating watershed cycle to facilitate effective watershed management. Michigan has 57 major watersheds based on the USGS's 8-digit HUCs. Water quality assessment efforts focus on a subset (approximately 20 percent) of these major watersheds each year (Figure 2.1).

In January 1997, EGLE completed a monitoring report entitled, "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (Strategy) (MDEQ, 1997). It was developed specifically to identify the activities and resources needed to establish a comprehensive, state-of-the-art water quality monitoring program, and has guided Michigan's monitoring program implementation. The Strategy consists of 9 interrelated elements: fish contaminants, water chemistry, sediment chemistry, biological integrity, wildlife contaminants, bathing beaches, inland lake quality and eutrophication, stream flow, and volunteer monitoring. The Strategy specifically identifies 4 monitoring goals:

- Assess the current status and condition of waters of the state and determine whether WQS are being met.
- Measure spatial and temporal water quality trends.

- Evaluate the effectiveness of water quality protection programs.
- Identify new and emerging water quality issues.

The evolving nature of management and program needs, technology, and technical monitoring guidance/science requires continuous evaluation of existing activities to ensure effective, comprehensive monitoring and to identify opportunities for improvement. Program assessment led to an update of the 1997 Strategy in May 2005 and again in January 2017 (MDEQ, 2017) (available at http://www.michigan.gov/egle under Water, Lakes and Streams, Water Quality Monitoring, Assessment of Michigan Waters, Monitoring Elements, A Monitoring Overview).

Regarding wetland monitoring, the 4 goals of Michigan's Water Quality Monitoring Strategy are addressed in a separate document entitled, "State of Michigan Wetland Monitoring and Assessment Strategy," which was updated in 2013. This strategy follows the 3-Tiered Technical Approach – Level 1: Landscape Assessment, Level 2: Rapid Wetland Assessment, and Level 3: Intensive Site Assessment - outlined of the USEPA publication, "Application of Elements of a State Wetland Monitoring and Assessment Program" (USEPA, 2006). The objectives of the wetland monitoring and assessment strategy are:

Objective 1: Complete an inventory of Michigan's wetland resources that provides both fundamental resource information and a baseline for evaluating gains and losses over time.

Objective 2: In order to support state and national no net loss/net gain goals for wetlands, cooperate in updating of National Wetland Inventory maps for use in status and trends reporting.

Objective 3: Assess the effectiveness of Michigan's state-administered Section 404 permit program by tracking authorized impacts and mitigation for those impacts, as well as documented unauthorized impacts and restoration measures.

Objective 4: Apply Landscape Level Functional Wetland Assessment methods to support the protection, management, and restoration of wetlands on a watershed scale.

Objective 5: Evaluate individual wetland sites using the Michigan Rapid Assessment Method to quickly assess the wetland functions and values on an equal scale regardless of ecological type.

Objective 6: Use full scale biological assessment of wetlands for resource management purposes. Develop and document wetland Indices of Biological Integrity and related methods.

Objective 7: In cooperation with other public and private agencies and organizations, provide for the evaluation of Michigan's most outstanding wetland resources, especially Great Lakes coastal wetlands, by supporting the long-term monitoring of wetlands through the Great Lakes Coastal Wetland Consortium and similar cooperative efforts.

Objective 8: Assess statewide wetland quality by establishing a routine wetland monitoring program that parallels other basin-wide water quality monitoring, including the National Wetland Condition Assessment.

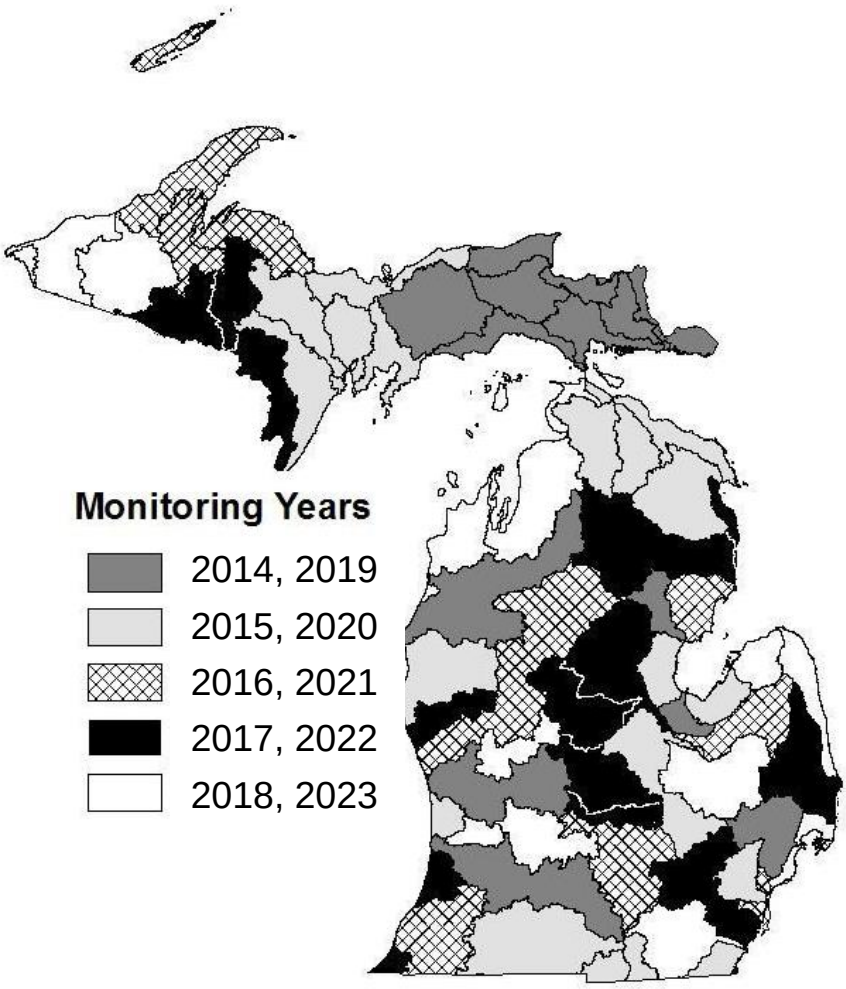


Figure 2.1. Five-Year Rotating Watershed Cycle.

CHAPTER 3
ASSESSMENT METHODOLOGY

3.1 Introduction

Michigan's assessment methodology describes the data and information used to determine designated use support, explains how these data and information are used to determine designated use support for surface waters of the state, and describes how surface water resources are reported using 5 categories (fully supporting, partially supporting, not supporting, insufficient information, or not assessed, described in more detail in Section 3.11). Ultimately, this methodology describes the process used to develop several of the appendices and summary tables included in this IR to satisfy the requirements of Sections 305(b) and 303(d) of the federal CWA.

The internal coordination and review process used to generate Sections 305(b) and 303(d) lists is carried out by a team of EGLE technical staff and managers with considerable knowledge of local watershed conditions/issues and expertise in aquatic biology, limnology, ecology, environmental engineering, chemistry, microbiology, and mammalian/aquatic toxicology.

3.2 Data and Information Used to Determine Designated Use Support

EGLE considers readily available, adequately georeferenced, and quality checked data and information collected and submitted by EGLE, its grantees and contractors, other agencies, and the public (including volunteer monitoring groups). Sources of data and information, in part, include:

- EGLE's water quality monitoring program that includes 8 interrelated elements: fish contaminants, water chemistry, sediment chemistry, biological integrity and physical habitat, wildlife contaminants, bathing beach monitoring, inland lakes monitoring, and stream flow (see Chapter 2).

  As part of EGLE's water quality monitoring program, sites for biological integrity and water chemistry monitoring are selected using both targeted and probabilistic study designs. The probabilistic monitoring approach is used to address statewide and regional questions about water quality. Targeted monitoring is used to fulfill specific monitoring requests, assess known or potential problem areas or areas where more information is needed, achieve assessment coverage of a watershed, and provide information to support and evaluate the effectiveness of EGLE water protection programs (e.g., National Pollutant Discharge Elimination System (NPDES), Nonpoint Source (NPS), and Site Remediation). All site-specific data are considered to determine designated use support. Generally, the other types of monitoring are conducted using targeted study designs.

- Michigan's 2016 IR (MDEQ, 2016), which serves as a baseline for the 2018 IR and is modified using new data and information.

- Fish Consumption Advisories established by the Michigan Department of Health and Human Services (MDHHS).

- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical, or biological integrity of surface water bodies.

- Reports of fish kills and chemical spills.

- Surface water quality monitoring data submitted by the general public or outside agencies. This information was solicited by EGLE in a notice on EGLE Web-based Calendar in the following publications: March 6, March 20, April 3, and April 17, 2017. Information was also solicited directly from governmental and non-governmental groups including the Michigan Department of Transportation, Michigan Department of Agriculture and Rural Development (MDARD), MDNR, United States Forest Service, USFWS, USGS, USEPA, National Parks Service, Alliance for the Great Lakes, Michigan Tribal contacts, various Michigan Colleges and Universities, watershed organizations, private consulting firms, and industrial water users via e-mail on March 6, 2017. Data received from outside sources, and if and how they were used are summarized in Section 9.2.

- Public Water Supply taste and odor complaints as well as surface water, drinking water, and source water quality assessments conducted under Section 1453 of the federal Safe Drinking Water Act, enacted by Public Law 93-523, December 16, 1974, as amended, through August 6, 1996, being Title 42 of the United States Code (U.S.C.), Section 300j-13.

- Remedial investigation/feasibility studies to support Records of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510 or Part 201 of the NREPA.

To ensure adequate time for proper data analysis, EGLE applies a cutoff date for newly collected data considered for the IR (i.e., data that were not used for development of the 2016 IR). For the 2018 IR, unless otherwise noted below or in the methodology under each use, EGLE considered all new readily available and quality-checked water quality data and information collected by EGLE and its grantees/contractors within the 2-year period immediately following the cutoff date considered for the 2016 IR. In other words, data collected during the period from January 1, 2015, to December 31, 2016, were considered for the 2018 IR. Data collected prior to January 1, 2015, that were unable to be used for the 2016 IR or that were helpful to understand conditions over a longer period of time given limited datasets were considered for the 2018 IR using the current assessment methodology.

A 7-year span of available data were used with Water Chemistry Monitoring Program (WCMP) data to capture multiple sampling events and provide better supporting information on conditions over time. WCMP data collected through 2015 were used for this IR. WCMP data collected in 2016 were not quality-checked in sufficient time to be broadly used for this IR. However, data collected in 2016 and after the December 31, 2016, cutoff date are occasionally considered for inclusion in the 2016 IR on a case-by-case basis as determined appropriate by EGLE. TMDL documents completed and approved by the USEPA through 2017 were used to prepare this IR. Water quality data collected since January 1, 2015, and submitted to EGLE by April 21, 2017, by other parties (e.g., in response to the data solicitation described in the above bulleted list, from the Michigan Clean Water Corps volunteer monitoring database, etc.) were evaluated according to this assessment methodology and potentially used to help prepare the 2018 IR.

The quality assurance/quality control requirements for water, sediment, and fish tissue chemistry and biological data collected by EGLE are described in EGLE's Quality Management

Plan (MDEQ, 2005). To ensure acceptable data quality, EGLE also requires all grantees or vendors receiving state or federal money for the purpose of conducting water quality monitoring to prepare and follow Quality Assurance Project Plans prior to sample collection (MDEQ, 2007). Other data, such as data submitted by outside agencies or the public, must satisfy EGLE's quality assurance/quality control requirements to be used to make designated use support determinations of supporting or not supporting, to change the designated use support, or to reassign water bodies to different categories. Data that do not fully satisfy EGLE's quality assurance/quality control requirements or data that are collected and analyzed using techniques that are less rigorous than techniques used by EGLE to make designated use support determinations may be used to list a water body for further evaluation (i.e., as insufficient information).

Each dataset for a water body is evaluated to determine if the data are representative of existing conditions and of adequate quality to make designated use support decisions. Data may not be representative of existing conditions if land use, point sources, or hydrologic conditions were substantially changed since the point of last data collection. Data may not be of adequate quality if field or laboratory methods changed to address quality concerns subsequent to data collection. In addition, the quantity of data; duration, frequency, magnitude, and timing of WQS exceedances; analytical method sensitivity; and contextual information (e.g., naturally occurring, weather, and flow conditions, etc.) are considered to ensure the data are representative of critical conditions. Target sample sizes may be given in this assessment methodology to determine designated use support; however, these sample sizes are not applied as absolute rules. Generally, data that are collected to determine compliance with permitted activities, such as NPDES discharge data, are not used to determine designated use support; however, ambient data that are collected for this purpose will be considered.

Water body, assessment, or data types that are not specifically discussed in this assessment methodology (including uncommon data or unusual circumstances) are considered on a case-by-case basis and are evaluated consistent with WQS.

3.3 Determination of Designated Use Support

At a minimum, all surface waters of the state are designated and protected for all of the following designated uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, and fish consumption (R 323.1100[1][a]-[g] of the Part 4 rules). In addition, all surface waters of the state are designated and protected for total body contact recreation from May 1 to October 1 (R 323.1100[2]). Specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fisheries (R 323.1100[4]-[7]). Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources (R 323.1100[8]). The Part 4 rules form the basis for this assessment methodology.

Most designated uses have one or more types of assessment that may be used to determine support. For example, to determine support for the other indigenous aquatic life or wildlife designated use, biological or physical/chemical assessment (e.g., rapid bioassessment of the macroinvertebrate community or chemical analysis of water samples) may be used. The assessment types include biological, habitat, physical/chemical, toxicological, pathogen indicators, other public health indicators, and other aquatic life indicators (default types from the USEPA ATTAINS). In addition, a variety of parameters may be considered for the same assessment type. For example, physical/chemical assessments to determine fish consumption designated use support may include analysis of mercury or PCB concentrations in the water column.

Michigan uses the principle of independent applicability when making a support determination for each designated use for each water body. If data for more than one parameter are available that are used to determine support for the same designated use, then each data type is evaluated independently to determine support for the designated use. If any one type of data indicates that the designated use is not supported, then generally, the water body is listed as not supporting that designated use. In some instances, data require reevaluation to resolve discrepancies. Some particular data types or situations may require consideration of multiple data types in combination. If no data are available for any assessment methods, then a water body is considered not assessed.

A single parameter may be used to make support determinations for more than one designated use. For example, appropriate data for a water body may reveal that water column mercury concentrations exceed the wildlife value and human noncancer value (HNV) (nondrinking water) (R 323.1057); therefore, both the other indigenous aquatic life and wildlife, and fish consumption designated uses are not supported. The inclusion of a parameter under a specific designated use in this assessment methodology does not preclude the use of that parameter to make support determinations for a different designated use.

Though infrequent, when best professional judgment (BPJ) is used to make a designated use support determination, justification is documented in the designated use comment field in the ATTAINS record.

Water bodies listed as having insufficient information will generally be revisited in the correct basin year as resources allow (Figure 2.1).

3.4 Designated Uses: Agriculture, Navigation, and Industrial Water Supply

3.4.1 Assessment Type: No Specific Indicator or Assessment Method

EGLE does not conduct specific assessments to evaluate support of the agriculture, navigation, and industrial water supply designated uses. These uses are assumed to be supported unless there is site-specific information indicating otherwise. In a scenario where site-specific information is used, the information is evaluated on a case-by-case basis using BPJ.

3.5 Designated Use: Warmwater Fishery and Coldwater Fishery

All surface waters of the state are designated and protected for warmwater fishery. In addition, specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fishery per R 323.1100(4)-(7).

3.5.1 Assessment Type: Physical/Chemical

For the following parameters the ideal dataset for assessments will come from continuous data collection or similar frequent collection over a target time frame. Collecting data of a sufficient frequency over an appropriate duration is important to fully investigate fluctuations in parameter quality over time and during critical periods (e.g., predawn and midday dissolved oxygen monitoring to investigate diurnal swings).

3.5.1.1 Dissolved Oxygen Concentration

Support determinations using dissolved oxygen data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other

monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment following the manufacturer's guidelines. Current quality assurance/quality control procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day, etc.) is especially important when making designated use determinations using dissolved oxygen concentrations. In general, a decision of "not supporting" for dissolved oxygen will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative measurements (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1064 and R 323.1065, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a 2-week period), BPJ remains a factor in any case of support determinations using ambient dissolved oxygen for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a 2-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

3.5.1.2 Temperature

Support determinations using temperature data will typically be based on continuous data collected over a time period (e.g., 2 weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment using manufacturer's guidelines. Current quality assurance/quality control procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day) is especially important when making designated use determinations using temperature. In general, a decision of "not supporting" for temperature will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative measurements (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1069, R 323.1070, R 323.1072, R 323.1073, or R 323.1075, depending on water body type, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a 2-week period), BPJ remains a factor in any case of support determinations using ambient temperature for the warmwater and coldwater fishery designated uses. During periods of extreme ambient air temperatures, it is assumed that stream temperatures will also rise. In some cases, this alone may cause temperatures to exceed criteria. BPJ to list a water body will be used in these situations. Likewise, it is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a 2-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

3.5.1.3 Ammonia (un-ionized) Concentration

Support determinations of chronic conditions using un-ionized ammonia data will typically be based on grab sample data collected over a time period (e.g., 1 week) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Consideration of other relevant parameters (e.g.,

temperature, pH, total ammonia) is especially important when calculating un-ionized ammonia concentration to make designated use determinations. In general, a decision of "not supporting" for un-ionized ammonia will be based on more than 1 exceedance of the monthly average (chronic) WQS per R 323.1057 over the period of review (typically 2 years, see 3.2) following USEPA guidance (USEPA, 1999).

Support determinations of daily maximum (acute) conditions using un-ionized ammonia data will be based on following USEPA guidance; when comparing ambient water column data to Aquatic Maximum Values, more than 1 exceedance of the acute un-ionized ammonia WQS over the period of review will typically result in assessing the site as not supporting (USEPA, 1999).

In addition to the guidelines outlined above, BPJ remains a factor in any case of support determinations using un-ionized ammonia for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a 2-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

3.5.1.4 pH

Support determinations using pH data will typically be based on continuous data collected over a time period (e.g., 2 weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment using the manufacturer's guidelines. Current quality assurance/quality control procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day) is especially important when making designated use determinations using pH. In general, a decision of "not supporting" for pH will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative samples (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1053, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a 2-week period), BPJ remains a factor in any case of support determinations using pH for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent that in using BPJ, a water body may be listed with a less rigorous set of data (e.g., the preferred continuous monitoring over a 2-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

3.5.1.5 Water Column Toxic Substance Concentrations

To determine warmwater and coldwater fishery designated use support using toxic substances that are non-Bioaccumulative Chemicals of Concern (BCC), ambient water column chemical concentrations are compared to Aquatic Maximum Values and Final Chronic Values per R 323.1057 using Figure 3.1a and following the process described in 3.6.1.1.

3.5.2 Assessment Type: Biological

3.5.2.1 Fish Community

In addition to chemical and physical assessment types, Michigan uses rapid bioassessment of fish communities in wadeable streams and rivers (generally Procedure 51 [P51] [MDEQ, 1990]) to determine support for the warmwater fishery and coldwater fishery designated uses. Fish community biosurvey sites are generally selected using targeted study designs.

Rivers and streams with no site-specific fish community biosurvey results are considered not assessed unless other data are available to assess this use as described elsewhere in this Section (3.5).

Using P51, warmwater fish communities are scored with metrics that rate water bodies from excellent (+5 to +10) to poor (-10 to -5). Fish ratings from -4 to +4 are considered acceptable (Creal et al., 1996). Water bodies with warmwater fish communities rating acceptable or excellent using P51 are determined to support the warmwater fishery designated use. Fish communities collected from designated coldwater streams using P51 are determined to support the coldwater fishery designated use if the relative abundance of salmonids is equal to or greater than 1%. One bioassessment result is generally considered sufficient to make this determination.

Using P51, a determination of not supporting or, infrequently, insufficient information is made for water bodies that have metrics that rate the warmwater fish community poor, have coldwater fish communities with salmonid relative abundance of less than 1%, if fewer than 50 fish are collected, or if the relative abundance of fish with anomalies exceeds 2% (applies to both warmwater and coldwater fisheries). Generally, targeted biosurvey results should have sufficient supporting information available to determine survey representativeness and to list the water body as not supporting using one survey result. However, instances where other supporting information raise concerns over data quality and representativeness (e.g., a poor fish community result during high-water conditions or when equipment function was in question) may require the collection of additional information to determine data representativeness. In this case, a determination of insufficient information is made.

For fish communities that rate poor, current and past weather conditions, assessments of biological communities in adjacent stream or river segments, historic data, and the source and frequency of pollutant exposure are considered to determine if conditions are ongoing or temporary. If conditions are determined to be temporary, a water body may be listed as having insufficient information. For example, a water body with a temporarily poor biological community due to a short-term chemical spill may be listed as having insufficient information if remediation occurred and the community is expected to recover.

Fish community data for streams, rivers, and lakes collected using methods other than P51 are evaluated on a case-by-case basis. For example, fish community data collected as part of the MDNR Fisheries Division's Status and Trend monitoring can be evaluated based on community structure and compared to the definitions for coldwater and warmwater fishery use as stated in R 323.1043 and R 323.1044. Additional factors considered in determining support of the fishery designated uses are the presence of indicator species such as cisco in coldwater lakes or walleye in warmwater lakes at densities sufficient to indicate water body support of a healthy food web that could maintain taxa of such trophic levels.

When evaluating this information, 2 biologists with fisheries experience independently assess fish community data relative to the definitions in the rules and their assessments are subsequently compared. Assessments with agreement (e.g., both biologists rating the data as

'fully supporting' the fishery designated use) are used to assess the appropriate assessment unit as such. Assessments with disagreement (e.g., one biologist rating the data as 'fully supporting' while the other rates it as 'not supporting') result in discussions of the data and agreement reached or a rating as 'insufficient information' to generate additional data collection to fully assess the assessment unit in question.

3.6 Designated Use: Other Indigenous Aquatic Life and Wildlife

3.6.1 Assessment Type: Physical/Chemical

3.6.1.1 Water Column Toxic Substance Concentrations

To determine other indigenous aquatic life and wildlife designated use support using toxic substances, ambient water column chemical concentrations are compared to Wildlife, Aquatic Maximum, and Final Chronic Values per R 323.1057 using Figures 3.1a and b, as described below. Water chemistry monitoring sites are selected using both targeted and probabilistic study designs. All site-specific water column chemistry data that are determined to be representative of current conditions are used to determine other indigenous aquatic life and wildlife designated use support. Additionally, site-specific water column chemistry data for non-BCCs are also used to determine warmwater and coldwater fishery designated use support, as described in Section 3.5.1.5. and illustrated in Figure 3.1a, below.

A minimum of 4 data points in a year are generally used to assess toxic substances per USEPA guidance (USEPA, 2002). In rare instances, and particularly in the case of acute WQS, limited data (less than 4 data points) demonstrating exceedance of WQS may be used to assess a water body as not supporting; if so, the basis for these decisions will be reflected in ATTAINS. A 7-year window of the most recent quality assured data is used for WCMP information to capture 2 probabilistic monitoring events spaced 5 years apart.

Following USEPA guidance, when comparing ambient water column data to Final Chronic Values for non-BCCs, more than one exceedance of the WQS over the period of review (typically 7 years in Michigan's review process) will typically result in assessing the site as not supporting, as illustrated in Figures 3.1a and 3.1b (USEPA, 2002). Similarly, to be reflective of the need to protect aquatic life against acute impacts, when comparing ambient water column data to Aquatic Maximum Values for BCCs and non-BCCs, 1 or more exceedance of the WQS over the period of review will typically result in assessing the site as not supporting, as illustrated in Figures 3.1a and b. For BCCs, comparisons of ambient water column data to Wildlife Values (the most sensitive chronic value) will be made using geometric means of available data as illustrated in Figure 3.1b. Geometric mean is chosen to help interpret the data when Wildlife Values are most sensitive because these criteria are based on long-term exposure of wildlife to surface water for drinking and consuming fish tissue. This is an analogous approach to that used when assessing human health protection as recommended per USEPA guidance (USEPA, 2002).

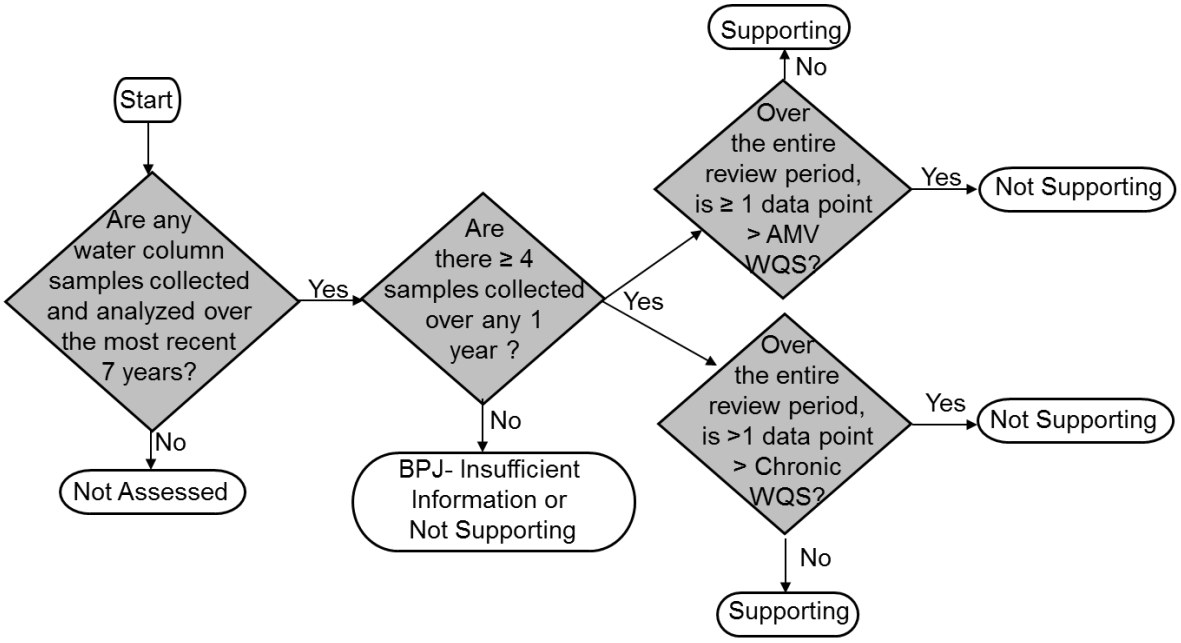


Figure 3.1a. Determination of other indigenous aquatic life and wildlife and warmwater/coldwater fishery designated uses support using water column toxic substance concentration for non-BCCs.

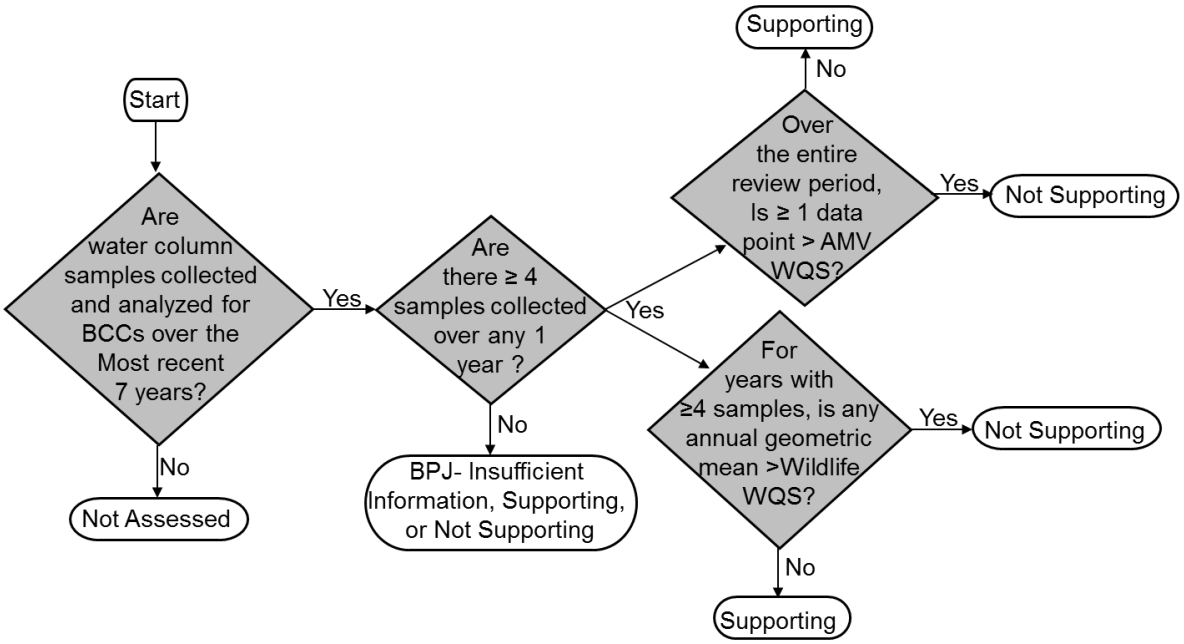


Figure 3.1b. Determination of other indigenous aquatic life and wildlife designated use support using water column toxic substance concentration for BCCs.

Site-Specific Aquatic Life Criteria may be developed following Rule 323.1057(2)(r)(ii). If Site-Specific Aquatic Life Criteria are developed, determination of designated use support status will be assessed following the processes in Figures 3.1a and b, as appropriate with water column data assessed against the corresponding Site-Specific Aquatic Life Criteria.

3.6.1.2 Water Column Nutrient Concentrations

For all waters, ambient water column nutrient concentrations are used in conjunction with biological indicators to determine support of the other indigenous aquatic life and wildlife designated use in all surface waters per R 323.1060 using BPJ to interpret conditions related to this narrative standard. Samples collected during July through September, when the impacts due to nutrient expression are most likely to occur, are particularly important for making designated use support determinations. In addition, use support determinations will be influenced by excessive/nuisance algal and macrophyte growth (see Section 3.6.2.2.).

Nutrient concerns may generate the need to conduct additional studies on possible ecological effects, including indirect effects to dissolved oxygen concentrations that may impact the fish community. If so, the results of those studies may be used to assess the warmwater and coldwater fishery designated uses following Section 3.5.1.1 thereby linking nutrient impacts to those uses as well as depending on the monitoring outcome.

For inland lakes, Carlson's trophic status index (TSI) in conjunction with aquatic macrophyte surveys, are considered to determine designated use support. Individual TSI values are calculated using summer data for each trophic state indicator: summer secchi depth (transparency), total phosphorus concentration (epilimnetic), and chlorophyll *a* concentration (photic zone) (Table 3.1). An overall TSI is determined from the mean of the individual indicator TSI values to provide a way of reducing the effects of individual sampling and measurement errors, thus developing a more robust estimate of the index. Based on these index values the trophic status classification is determined as listed in Table 3.2 (Fuller and Taricska, 2012). Carlson's index may underestimate the trophic state of lakes dominated by macrophytes. Therefore, the relative abundance of submergent macrophytes, if available, is used to indicate more productive conditions than indicated by the TSI values. It is assumed that moderate and dense growths of macrophytes are indicative of mesotrophic and eutrophic conditions, respectively. Therefore, if Carlson's TSI indicate mesotrophic conditions, but dense macrophytes are present, the lakes will be classified eutrophic (MDNR, 1982).

Trophic state determinations for inland lakes in Michigan has typically used data collected during comparable late summer time frames with consistent sample collection methods (e.g., primarily EGLE TMDL monitoring data, USGS Lake Water Quality Assessment data [Fuller and Taricska, 2012], or Cooperative Lake Monitoring Program volunteer data [https://micorps.net/lake-monitoring/individual-lake-reports/]). However, data from other sources and gathered using somewhat different methods or time frames is not completely discounted and may be used to calculate TSI values at lakes where no other TSI information is available. For example, the use of data collected prior to 2013 during the USEPA-sponsored National Lakes Assessments of 2007 and 2012, and by Michigan tribes, the National Park Service, and potentially other sources (e.g., MDNR, Fisheries Division) is considered on a case-by-case basis. The total phosphorus and chlorophyll *a* samples collected during these efforts may deviate from the standard sampling methods used by EGLE at Michigan lakes to characterize TSI, but remains useful for assessments.

Inland lakes classified as oligotrophic, mesotrophic, or eutrophic are generally determined to support the other indigenous aquatic life and wildlife designated use, unless other information exists regarding designated use impacts resulting from excess nutrients (e.g., persistent and significant algal blooms). Inland lakes that are classified as hypereutrophic, but without additional supporting information regarding nutrient expression, are generally listed as insufficient information with the goal of conducting additional site-specific monitoring to confirm the trophic designation and whether impairments of the designated uses are realized.

Table 3.1. Carlson's TSI Equations.	
TSI_{SD} = 60 - 14.40 lnSD	SD = Secchi depth transparency (m)
TSI_{TP} = 4.15 + 14.42 lnTP	TP = total phosphorus concentration (ug/l)
TSI_{CHL} = 30.6 + 9.81 lnCHL	CHL = chlorophyll *a* concentration (ug/l)

Table 3.2 Michigan Inland Lakes Trophic Status Classification Criteria.				
Trophic State	Carlson's TSI	TP (ug/l)	SD (m)	CHL (ug/l)
Oligotrophic	<38	<10	>4.6	<2.2
Mesotrophic	38-48	10-20	2.3-4.6	2.2-6
Eutrophic	49-61	21-50	0.9-2.2	6.1-22
Hypereutrophic	>61	>50	<0.9	>22

3.6.1.3 Ammonia (un-ionized) Concentration

Support determinations of chronic and acute conditions using un-ionized ammonia data to assess the other indigenous aquatic life and wildlife designated use follow the processes found in Section 3.5.1.3.

3.6.1.4 pH

Support determinations using pH data to assess the other indigenous aquatic life and wildlife designated use will follow the process found in Section 3.5.1.4.

3.6.1.5 Physical Characteristics

R 323.1050 addresses the following physical characteristics of a water body: turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, and deposits. Michigan does not have specific assessment methods or numeric standards for these physical characteristics; therefore, BPJ (including visual observation) in conjunction with other assessment types (e.g., biological) is used to determine the other indigenous aquatic life and wildlife designated use support based on this narrative standard.

3.6.2 Assessment Type: Biological

3.6.2.1 Macroinvertebrate Community

In addition to chemical and physical assessment types, Michigan uses rapid bioassessment of macroinvertebrate communities in wadeable streams and rivers (generally P51; MDEQ, 1990) to determine support for the other indigenous aquatic life and wildlife designated use. Using P51, macroinvertebrate communities are scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Macroinvertebrate ratings from -4 to +4 are considered acceptable (Creal et al., 1996). Biosurvey sites are selected using both targeted and probabilistic study designs. All biosurvey data are considered to determine other indigenous aquatic life and wildlife designated use support.

Rivers and streams with no site-specific macroinvertebrate community biosurvey results are considered not assessed unless other data are available to assess the use as described elsewhere in this Section (3.6).

Water bodies with macroinvertebrate communities rating acceptable or excellent (i.e., total P51 macroinvertebrate community score -4 to +9) are determined to support the other indigenous aquatic life and wildlife designated use. One bioassessment result is generally considered sufficient to make this determination.

A determination of not supporting or, infrequently, insufficient information is made for water bodies with macroinvertebrate communities rated poor (total P51 macroinvertebrate community score -5 to -9). Generally, targeted biosurvey results should have sufficient supporting information available to determine survey representativeness and to list the water body as not supporting using one survey result. For biological communities that rate poor, current and past weather conditions, relevant available historic data, assessments of biological communities in adjacent stream or river segments, and the source and frequency of pollutant exposure are considered to determine if conditions are ongoing or temporary. In all cases, ATTAINS reflects the information used to support the assessment decisions.

Macroinvertebrate data for wadeable streams and rivers collected using methods other than P51 are evaluated on a case-by-case basis. Similarly, biological integrity data regarding water bodies where P51 is not appropriate (e.g., wetlands, lakes, ephemeral streams, etc.) will be evaluated on a case-by-case basis using BPJ to assess community characteristics like taxa balance, diversity, and other indicators of system health and function.

Nonwadeable rivers are assessed using Michigan's Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers (MDEQ, 2013a). Using this nonwadeable procedure, macroinvertebrate communities are scored with metrics that rate water bodies from excellent to poor. Macroinvertebrate ratings from 76-100 are considered excellent, 50-75 good, 25-49 fair, and 0-24 are considered poor.

Nonwadeable rivers with macroinvertebrate communities rating excellent, acceptable, or fair (i.e., total macroinvertebrate community score ≥25) are determined to support the other indigenous aquatic life and wildlife designated use. One bioassessment result is generally considered sufficient to make this determination.

Similar to determinations made for wadeable streams and rivers, a determination of not supporting or insufficient information is made for nonwadeable rivers with macroinvertebrate communities rated poor (total macroinvertebrate community score 0-24) depending on the quality and amount of supporting contextual information available.

3.6.2.2 Bacteria, Algae, Macrophytes, and Fungi

Site-specific visual observation of bacteria, algae, macrophytes, and fungi may be used to make a support determination for the other indigenous aquatic life and wildlife designated use. In addition, water column nutrient concentrations may also be used to support this determination (see Section 3.6.1.2).

A determination of not supporting will be made if excessive/nuisance growths of algae (particularly, *Cladophora*, *Rhizoclonium*, and cyanobacteria) or aquatic macrophytes are present. Although the determination of excessive, nuisance conditions is generally made using BPJ in accordance with narrative WQS, P51 offers the following guidance to make these determinations for streams:

- *Cladophora* and/or *Rhizoclonium* greater than 10-inches long covering greater than 25% of a riffle.
- Rooted macrophytes present at densities that impair the designated uses of the water body.
- Presence of bacterial slimes.

For inland lakes and impoundments, chlorophyll *a* (used as a surrogate for algal biomass) is a component of the TSI calculation and is used quantitatively to determine the trophic state (see Section 3.6.1.2).

3.6.2.3 Sediment Toxicity

The results of sediment toxicity studies on freshwater invertebrates may be used in conjunction with supporting data from sediment chemistry analyses and/or additional site-specific information, to make support determinations for the other indigenous aquatic life and wildlife designated use. Sediment toxicity tests must be conducted following USEPA Methods 100.1 or 100.2, or a similar test, and must incorporate test acceptability requirements and other quality control steps (USEPA, 2000). It is important from an assessment standpoint that the control-corrected sediment toxicity be further supported by additional information, which lends confidence to the results and reduces the potential of making a listing decision based on possible laboratory error during the testing process. As such, sediment analyses, in-situ biological assessments, or other information in support of toxicity analyses results are necessary to make a full assessment determination following the process in Figure 3.2.

The determination of spatial area represented by toxicity tests will rely on associated information regarding sediment deposit mapping and other site-specific information that supports the likely extent of impacted areas.

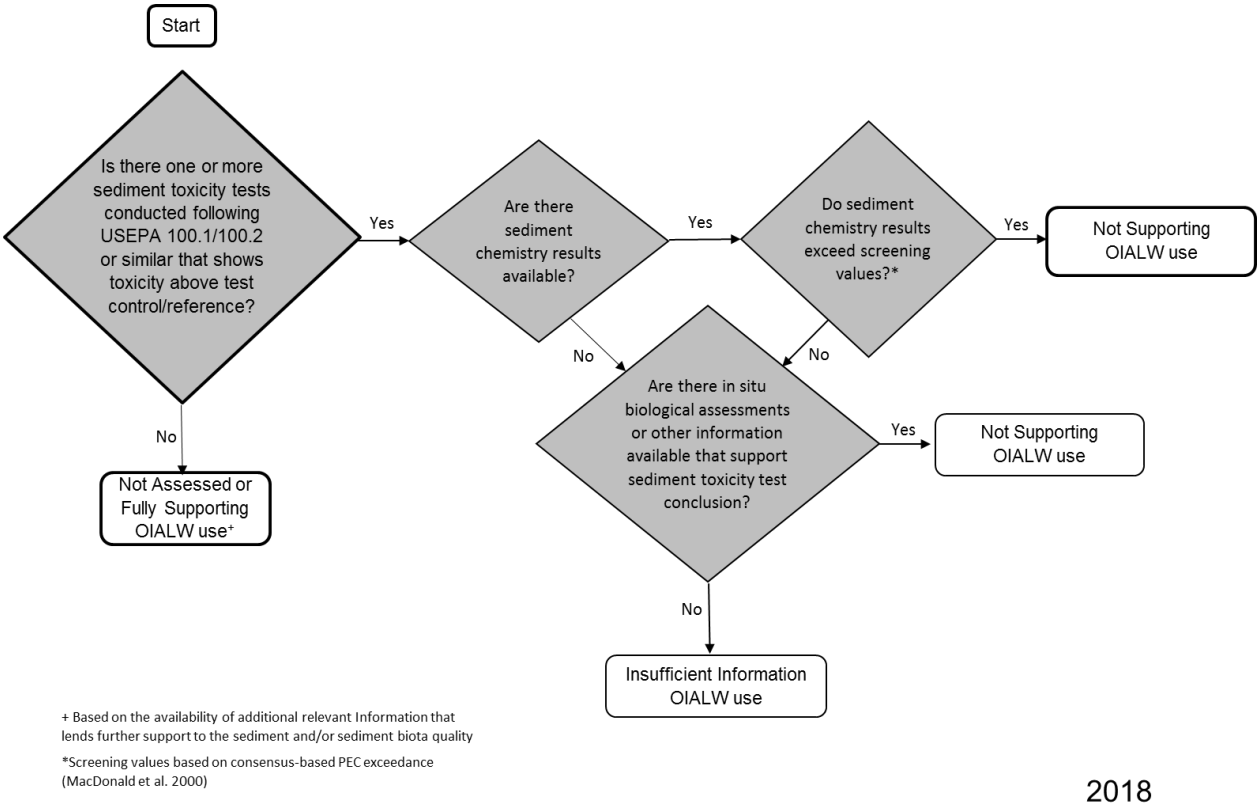


Figure 3.2. Determination of other indigenous aquatic life and wildlife designated use support using sediment toxicity.

3.7 Designated Use: Partial Body Contact Recreation and Total Body Contact Recreation

The partial body contact recreation designated use applies to all water bodies the entire year, while the total body contact recreation designated use applies to all water bodies during May 1 to October 31.

3.7.1 Assessment Type: Pathogen Indicators

3.7.1.1 *E. coli*

Michigan uses ambient *E. coli* concentration, and the presence of raw sewage discharges, to determine partial body contact and total body contact recreation designated use support using Rule 323.1062 and following Figures 3.3a and 3.3b, respectively. A minimum of 5 sampling events are needed to assess the partial and total body contact recreation designated uses using *E. coli* data. For the 30-day geometric mean total body contact WQS to be evaluated, the sampling events must be "representatively spread over a 30-day period" (Rule 323.1062). A sampling event is defined by Rule 323.1062 as "three or more samples taken during the same sampling event at representative locations within a defined sampling area." Larger datasets (e.g., weekly over the total body contact season or over multiple years) should be used to their fullest extent when available to assure that changing conditions during the year or over multiple years are adequately represented; for example, assessments of bathing beaches for which the most recent 2 years of data indicate a shift in status (fully supporting to not supporting or vice versa), were expanded to use an additional year of data to increase confidence in changing conditions. A 10 percent exceedance threshold is targeted for making designated use determinations following USEPA guidance (USEPA, 2002). However, discretion may be used when considering a single violation and the magnitude of the exceedance under certain circumstances using small datasets (USEPA, 2002).

The representativeness of *E. coli* data is critical in assessing use attainment. It is important that the *E. coli* data used be spaced over time to represent a range of conditions rather than be clustered around a single event (e.g., single rain event or a single dry weather event). It is acceptable to sample during a critical 30-day period that may be driving *E. coli* concentrations (e.g., summer low flow, wet weather conditions) as long as they are distributed representatively over that time frame. Data used for reassessing an assessment unit previously listed as not supporting should, at a minimum, capture conditions that were reflected in the data used to make the initial assessment. For example, if wet weather events were captured as part of an initial dataset used to list an assessment unit as not supporting, it would be inappropriate to use only dry weather data to assess for delisting purposes. Additionally, when using more extensive datasets, the breadth of the data used is contingent on confidence that it represents conditions and variability typical of the water body being assessed.

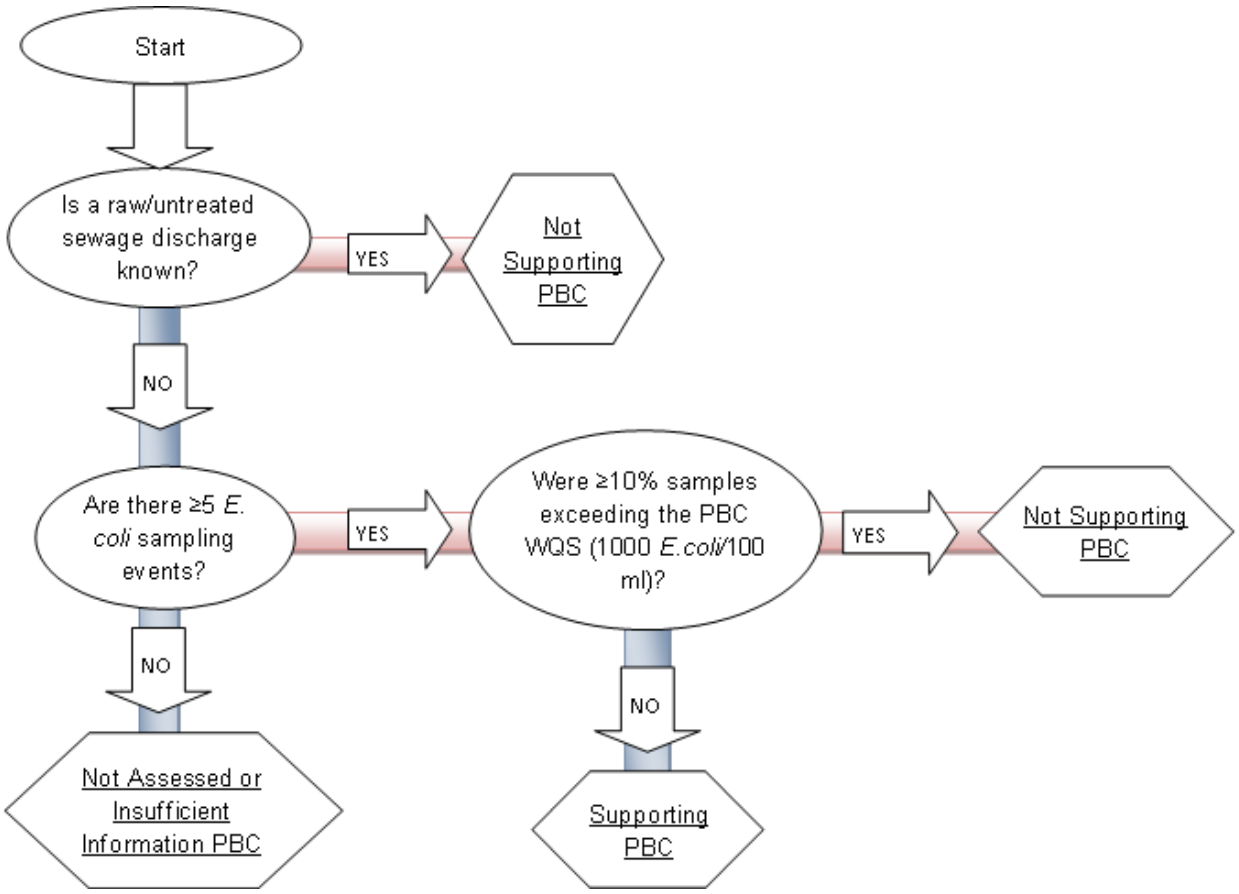


Figure 3.3a. Determination of partial body contact designated use support using ambient *E. coli* water column concentration. See Section 3.7.1.1 for additional details.

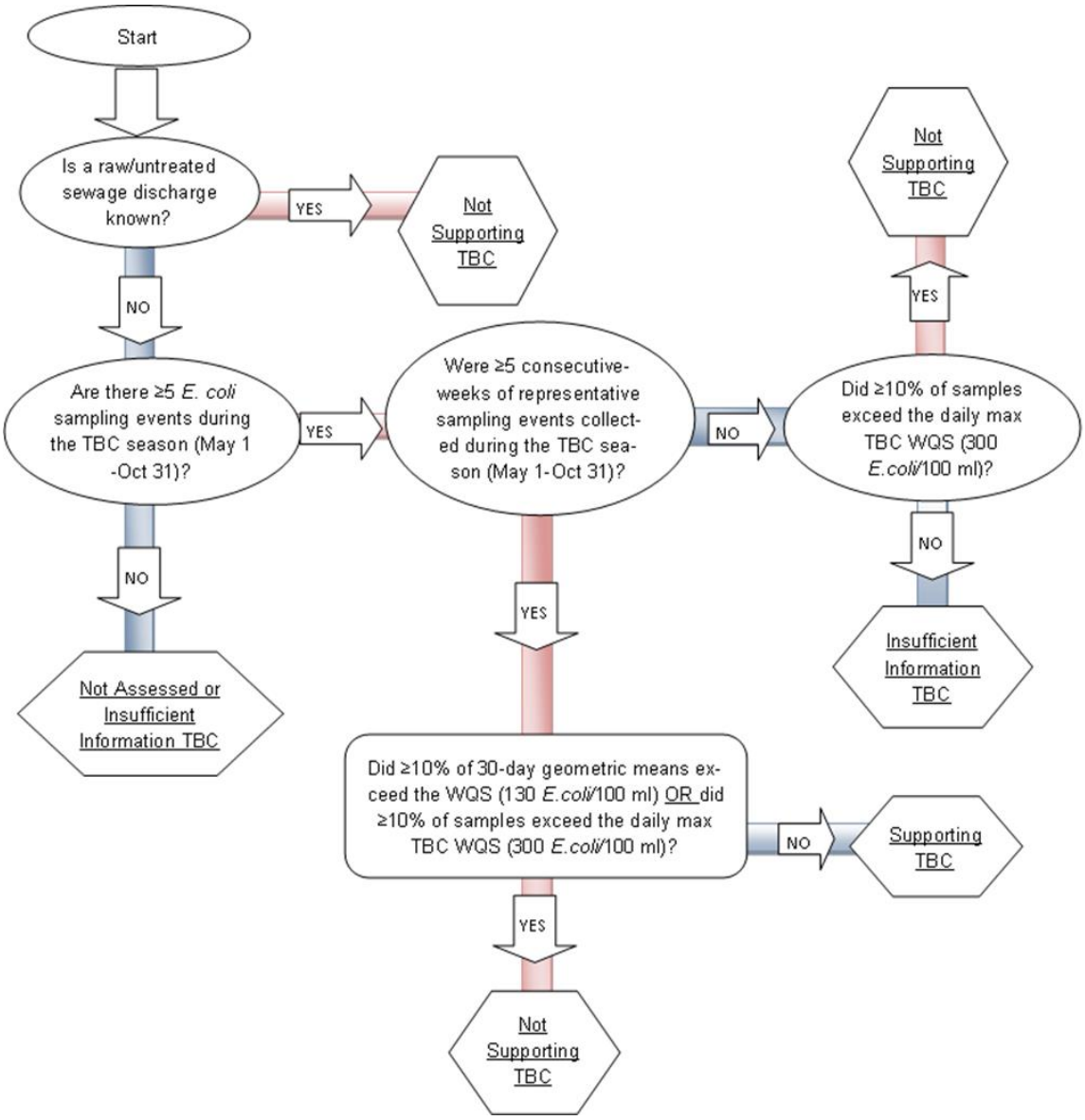


Figure 3.3b. Determination of total body contact designated use support using ambient *E. coli* water column concentration. See Section 3.7.1.1 for additional details.

3.7.2 Assessment Type: Physical/Chemical

3.7.2.1 pH

A determination of not supporting may be made in situations where the pH of surface water is such that direct human contact presents an opportunity for physical danger (e.g., contaminated groundwater venting from cement kiln dust disposal sites). Although infrequent, in such situations decision processes will be captured in relevant comment fields under affected Assessment Units within ATTAINS.

3.8 Designated Use: Fish Consumption

Michigan uses the concentration of BCCs (as listed in Table 5 of the Part 4 Rules) and other bioaccumulative substances (selenium and perfluorooctane sulfonate) in the water column, and fish consumption advisories issued by the MDHHS to determine fish consumption designated use support. A water body is considered to not support the fish consumption designated use if either the MDHHS has issued a site-specific fish consumption advisory for that water body or ambient water column concentrations exceed WQS, as described below.

3.8.1 Assessment Type: Physical/Chemical

3.8.1.1 Water Column and Fish Tissue Mercury Concentrations

A fish consumption designated use decision based on ambient water column mercury concentrations is made by comparing mercury concentrations in the water with the HNV (nondrinking water) WQS (1.8 nanograms per liter [ng/L]) following the flow chart in Figure 3.4. In keeping with the assessment process spelled out in Section 3.6.1.1, geometric mean is chosen to help interpret the data when comparing to HNV because these criteria are based on long-term exposure to surface water for consuming fish tissue.

Michigan's fish tissue mercury value development method is similar to the USEPA's development method for the national fish tissue criterion (USEPA, 2001). Michigan's fish tissue mercury value (0.35 milligrams per kilogram [mg/kg]) was derived using the same exposure scenario used to derive Michigan's HNV (nondrinking water) WQS of 1.8 ng/L. Michigan's fish tissue value for mercury is the concentration that is not expected to pose a health concern to people consuming 15 grams or less of fish per day. This fish tissue value of 0.35 mg/kg for mercury is used as the decision point for making nonattainment listing decisions using the associated MDHHS advisory level, which encompasses that concentration. Therefore, the presence of MDHHS fish consumption advisories of 2 meals per month, or more restrictive, are used as a basis for a not supporting assessment. The 2 meal per month MDHHS advisory level based on mercury equates to tissue mercury concentrations in edible portions over a range (0.27-0.53 mg/kg wet weight), encompassing Michigan's fish tissue value for mercury (0.35 mg/kg wet weight).

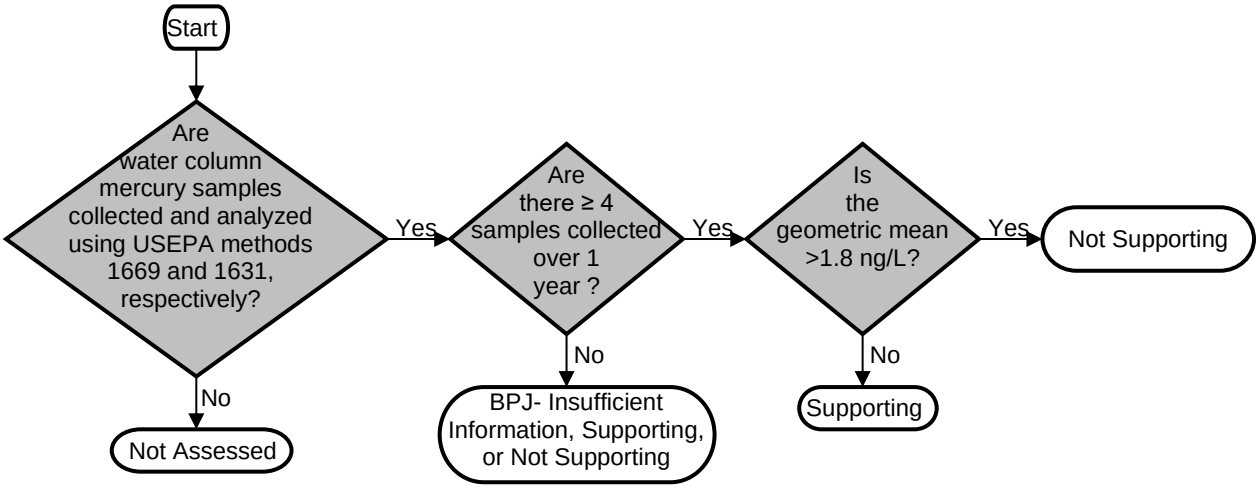


Figure 3.4. Determination of fish consumption designated use support using water column mercury concentration.

3.8.1.2 Water Column PCB Concentration

To determine fish consumption designated use support for PCBs, the ambient water column PCB concentration is compared to the non-drinking water Human Cancer Value (HCV) (0.026 ng/L) (R 323.1057). PCB samples should be collected and analyzed according to protocols published by the USEPA (1997a and 1997b), with the exception that dissolved and particulate fractions are combined. For PCBs, a sample size of 1 is considered sufficient information to determine WQS nonattainment. This approach is justified by the existence of a large PCB dataset for the state as a whole, which shows virtually 100% exceedance of the HCV for total PCBs. If there are no appropriate PCB data, then a water body is considered not assessed. Water bodies with 1 or more ambient water column PCB sample results greater than the non-drinking water HCV are determined to not support the fish consumption designated use.

3.8.1.3 Water Column BCCs Concentration other than Mercury and PCBs

To determine fish consumption designated use support for BCCs other than mercury and PCBs in the water column, ambient water column chemical concentrations are compared to the HNV and HCV for nondrinking water per R 323.1057 using Figure 3.1b (see Section 3.6.1.1).

3.8.2 Assessment Type: Other Public Health Indicators

The MDHHS bases their "Eat Safe Fish" Guidance (advisory) on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program. The fish tissue value is not an ambient WQS; however, EGLE considers the use of the MDHHS advisory based on fish tissue data as appropriate for determining fish consumption designated use support. For example, a fish consumption advisory due to PCBs on a water body specific basis occurs when the upper 95% confidence limit on the mean total PCB concentration in fillet samples of any species exceeds 0.01 mg/Kg (wet weight). The MDHHS has developed advisory screening values for mercury, total PCBs, total DDT, dioxins, toxaphene, selenium, and perfluorooctane sulfonate. Information specific to the MDHHS fish consumption advisory issuance process can be found on the MDHHS Web site (http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html).

3.8.2.1 Fish Consumption Advisories for Mercury

As described in Section 3.8.1.1, the presence of MDHHS fish consumption advisories of 2 meals per month, or more restrictive, are used as a basis for a not supporting assessment.

3.8.2.2 Fish Consumption Advisories for BCCs and other bioaccumulative substances other than Mercury

For contaminants other than mercury, a water body is considered to not support the fish consumption designated use if the MDHHS has issued a site-specific fish consumption advisory for that water body recommending a consumption rate of 12 meals or less per month. The MDHHS bases their advisories on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program. The fish tissue value is not an ambient WQS; however, EGLE considers the use of the MDHHS advisory listing based on fish tissue data as appropriate for determining fish consumption designated use support. For example, a fish consumption advisory due to PCBs on a water body-specific basis occurs when the upper 95% confidence limit on the mean total PCB concentration in fillet samples of any species exceeds 0.01 mg/kg

(wet weight). Information specific to the MDHHS fish consumption advisory issuance process can be found on the MDHHS Web site (http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html). The MDHHS is developing advisory screening values for all fish contaminants.

3.9 Designated Use: Public Water Supply

Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources [R 323.1100(8)].

3.9.1 Assessment Type: Physical/Chemical

3.9.1.1 Toxic Substances in Water Column

Assessment of public water supply designated use support determination is problematic because the HNV and HCV for drinking water (surface WQS) calculations assumes exposure via the consumption of 2 liters of untreated water per day, but it also assumes exposure via the consumption of 15 grams of fish per day. The majority of human exposure to compounds that are shown to have a potential to bioaccumulate using this exposure scenario would be from the consumption of fish. In other words, based on the process used to develop the HNV and HCV WQS the relative human exposure to a BCC and many non-BCC toxics in surface waters via strictly water consumption is minimal. Currently, Michigan's Part 4 rules do not contain a methodology to derive human health values that protect humans solely for the consumption of 2 liters of untreated surface water per day. However, for compounds that do not have the potential to bioaccumulate (generally, a bioaccumulation factor of 1) the drinking water HNV and HCV WQS can be used directly to assess the public water supply designated use.

Conversely, for compounds where bioaccumulation has been demonstrated to be an important component in human exposure (generally, a bioaccumulation factor >1), a surrogate screening value will be used to assess the public water supply designated use. In these cases, the Maximum Contaminant Levels (MCL) will be used to compare to water column data from an assessment standpoint. The MCLs are used by EGLE's, Drinking Water Program, as the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. The MCLs are solely based on the consumption of two liters of water and do not include a fish consumption component in the calculation; because of this, it was decided that MCLs were reasonable to use as a screening value for water column comparison for toxics where bioaccumulation makes direct comparison to WQS inappropriate. Because the MCL is a standard applicable after treatment, an exceedance of an MCL will not be used as the basis for a nonattainment determination. Instead, the water body will be assessed as "Insufficient Information" indicating the need for further investigation and additional coordination with EGLE's, Drinking Water Program, to complete a full assessment.

Data used for public water supply assessments should be reflective of conditions within the Critical Assessment Zone (CAZ) for Great Lakes intakes or in the upstream portion of 12-digit HUCs and any additional waters identified by the SDWA staff for inland intakes, as described in Section 3.10, for a particular intake. Similar to the assessment methods used in Section 3.6.1.1, and USEPA guidance, a minimum of four annual data points are generally used to assess toxic substances following Figure 3.5 (USEPA, 2002). The geometric mean of ambient water sample results from a CAZ will be compared to either the WQS or the MCL, as appropriate following the process in Figure 3.5. Geometric mean is chosen to help interpret the surface water data for WQS or MCL comparison because these levels are based on long-term

exposure of humans to surface water for drinking. In rare instances, limited data (less than 4 data points) demonstrating extreme exceedance of WQS may be used to assess a water body as not supporting the Public Water Supply designated use; if so, the basis for these decisions will be reflected in ATTAINS.

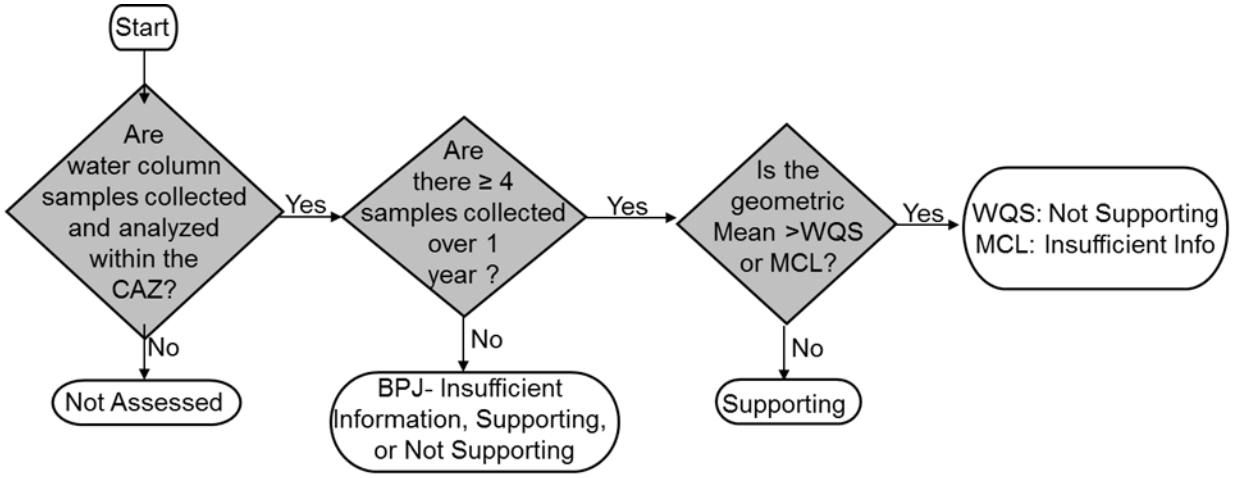


Figure 3.5. Determination of the Public Water Supply designated use support using WQS or MCLs.

3.9.1.2 Chlorides

Designated use support determination using chlorides data is made on a case-by-case basis where one or more representative monthly average calculations can be made and compared to R 323.1051(2). With consistent ambient monitoring data (e.g., ambient drinking water intake data) the WQS will be considered not supporting the Public Water Supply designated use if more than 10 percent of samples during the period of review exceed the applicable WQS.

3.9.1.3 Taste and Odor

To determine public water supply designated use support, site-specific complaints of taste and odor causing substances in community source waters are considered on a case-by-case basis.

3.9.1.4 Nitrates

Elevated nitrates in drinking water source water can lead to acute health concerns, particularly in infants. The nitrate WQS and MCL are both 10 mg/L to be protective of methemoglobinemia in infants. Nitrate data used for Public Water Supply assessments should be reflective of conditions within the Critical Assessment Zone (CAZ) or inland 12-digit HUC and relevant additional waters, as described in Section 3.10, for a particular intake. Similar to the assessment methods used in Section 3.6.1.1, a minimum of four annual data points are generally used to assess nitrate conditions in surface waters as supporting the Public Water Supply designated use. However, due to the acute nature of the health impacts, one or more exceedances of the 10 mg/L WQS will lead a not supporting assessment.

In rare instances, limited data (less than 4 data points) demonstrating extreme exceedance of WQS may be used to assess a water body as not supporting the Public Water Supply designated use; if so, the basis for these decisions will be reflected in ATTAINS.

3.9.1.5 Total Microcystins

The relationship between microcystins and their environmental drivers is complicated and not well understood. From a Public Water Supply assessment standpoint in Michigan, the understanding of expectations for natural background concentrations, the susceptibility of surface water drinking water intakes to microcystins, and expectations for conventional treatment efficacy need to be more fully explored. Although the presence of microcystins in source water may necessitate additional treatment from a SDWA program standpoint, the link between that need and the presence of total microcystins in source water that indicates something unnatural and caused by a pollutant may not be clear in many cases.

The USEPA developed health advisory (HA) levels for total microcystins in finished drinking water in 2015. While non-regulatory, these HA levels serve as guidance and provide concentrations at or below which adverse health effects are not anticipated over a 10-day duration. Two HA levels were developed, one (1.6 ug/L) for school-age children through adults and one (0.3 ug/L) for pre-school age children under six years old. Practically speaking, the more conservative HA level of 0.3 ug/L offers a level at which the entire population is protected. These HA levels are important in providing meaningful targets for SDWA programs from a treatment perspective.

The presence of microcystins in drinking source water, while treatable, often presents the need for water treatment facilities to upgrade from conventional treatment to address a source water quality problem. The detection of microcystins in raw intake water above the HA level indicates that, without additional treatment, the source water body may not provide suitable potable water. However, the ability to differentiate between possibly naturally occurring occasional total microcystins from those caused or exacerbated by pollutants, differentiates between possible assessments for the PWS use from a surface water standpoint. It should be noted that the designated use assessment has no bearing on the decisions made in the SDWMA program regarding the need to provide additional treatment to protect human consumption.

There are no cyanotoxin water quality criteria for the protection of the public water supply designated use. However, the Public Water Supply designated use may be assessed with a combination of total microcystins monitoring data in raw source water and information on the condition of that water body in the vicinity of the intake related to nutrient inputs and other indications of source water quality issues (e.g. documented blooms of algae or cyanobacteria, observed scums, elevated chlorophyll-a). To assess the public water supply designated use total microcystins data should be gathered monthly, at a minimum, during the growth season (June through September).

In cases where two or more total microcystins results in surface water exceed the more conservative HA level of 0.3 ug/L in a 3-year period and are supported by documented eutrophication and nuisance nutrient conditions in the same 3-year period (see Section 3.6.2.2) that are likely causative, an assessment of Not Supporting the use may be made. Exceedance of the HA level must be at least 30 days apart to reflect cyanotoxin events that are either repeating frequently, or substantial in duration.

In rare circumstances, BPJ may be used to assess a water for the Public Water Supply designated use based on different 'weight of evidence' scenarios. However, the presence of total microcystins alone, particularly with limited monitoring data, will typically result in an assessment of Insufficient Information until additional support linking those concentrations to conditions related to human impacts on the water body.

3.10 Assessment Units and Determination of Geographic Extent

Michigan uses the NHD coding scheme (1:24,000 resolution) to georeference water bodies when generating the Sections 305(b) and 303(d) lists. As a base assessment unit, Michigan uses 12-digit HUCs (Appendix A). The geographic extent of a designated use support determination for each water body is made on a case-by-case basis. The 12-digit HUC base assessment unit is used as a default when listing streams and rivers to facilitate record keeping and mapping. Each 12-digit HUC base assessment unit may be split into multiple assessment units if site-specific information supports a smaller assessment unit (e.g., contextual information such as land use, known areas of contamination, point source pollution location, specific fish consumption advisory geographic information, barriers such as dams that restrict fish migration, etc.). An assessment unit may consist of all water bodies in a 12-digit HUC (as a maximum) or specific stream segments or lakes in a 12-digit HUC.

Beyond using the 12-digit HUC as a base assessment unit, contextual information is considered when making a determination of the geographic extent that data collection points represent. For example, if a macroinvertebrate community survey conducted in the lower reach of a branch of a river indicates support of the other indigenous aquatic life and wildlife designated use and a second survey conducted farther upstream (several 12-digit HUCs upstream) in the same river branch also indicates designated use support, then contextual information may be considered to make a determination that the spanned river miles also support the designated use. In this example, contextual information may include similar physical habitat, similar land use, absence of point sources, absence of contaminated sites, etc. Similarly, if an intensive riverine *E. coli* monitoring is conducted, the results from that study may be applied to adjacent assessment units if supported by additional information like land use and more reduced *E. coli* grab sampling data. In other words, if contextual information indicates that it is appropriate, data collected from an assessment unit may be used to make designated use determinations for surrounding water body segments in different assessment units that lack data.

For the public water supply designated use in inland intakes, the geographic extent of the assessment unit is generally the upstream portion of the 12-digit HUC in which the intake is located and may include additional waters identified by site-specific input by SDWA program staff.

For public water supply intakes that are located in the Great Lakes or connecting channels, a concept of a CAZ around each intake was developed based on a Sensitivity Factor calculated for each intake. The two attributes used to develop the Sensitivity Factor are the water depth above the intake structure and the perpendicular distance from shore or length of the intake pipeline. Other factors such as localized flow patterns, thermal effects, wind effects, lake bottom characteristics, benthic nepheloid layers, etc., may be used to complete the sensitivity analysis. A radius for the CAZ, ranging from 3,000 feet for the most sensitive intakes to 1,000 feet for the least sensitive intakes, is assigned based on the Sensitivity Factor. A shape with this radius is then drawn around the intake to illustrate the CAZ. If the CAZ intersects the shoreline, then the geographic extent of the assessment unit is determined on a case-by-case basis as the most influential 12-digit HUCs that are along the shoreline within the CAZ. For

intakes that are located in open waters of the Great Lakes where the CAZ does not intersect the shoreline, the geographic extent of the assessment unit is 1.5 square miles.

Ultra low-level PCB monitoring conducted by the EGLE indicates that PCB concentrations exceed the HCV WQS (0.026 ng/L) in all waters sampled. Based on these results, all river miles in the individual watersheds sampled for PCBs are listed as not supporting the fish consumption designated use for PCBs in the water column.

The geographic extent of some beaches is not currently available. In these instances, a geographic extent of 0.2 shoreline miles was used as a default value.

Streams and rivers are listed in terms of miles. Wetlands are listed in terms of acres. Generally, inland lakes are listed in their entirety as acres, and Great Lakes and bays are listed in terms of square miles, except for Great Lake and inland lake beaches, which are listed in terms of shoreline miles for pathogen concerns.

3.11 Assessment Unit Assignment to Categories

After support determinations for all designated uses and geographic extent decisions are made for an assessment unit, categories are assigned using a multiple category system. The following categories and subcategories are used:

Category 1: All designated uses are supported, no use is threatened.

Category 2: Available data and/or information indicate that some, but not all of the designated uses are supported.

Category 3: There is insufficient available data and/or information to make a designated use support determination.

Category 4: Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.

- Category 4a: A TMDL to address the impairment-causing pollutant has been approved or established by the USEPA.
- Category 4b: Other approved pollution control mechanisms are in place and are reasonably expected to result in attainment of the designated use within a practical time frame.
- Category 4c: Impairment is not caused by a pollutant (e.g., impairment is due to lack of flow or stream channelization).

Category 5: Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

An assessment unit is considered threatened and is placed in Categories 4 or 5 when water quality data analysis demonstrates a declining trend that is expected to cause that water body to not attain WQS by the next listing cycle (2020). An assessment unit is not attaining WQS when any designated use is not supported (i.e., Category 4 or 5). Assessment units placed in Category 5 form the basis for the Section 303(d) list and the TMDL development schedule (see Chapter 8 for additional information regarding TMDLs).

Statewide TMDLs have been developed for PCBs and mercury and approved by the USEPA. It is anticipated that future assessments involving PCB or mercury data determined to be atmospheric in source (vs. an otherwise locally controllable source from legacy contamination or point-source conditions) will be assigned to Category 4a based on the existence of the approved statewide TMDLs. More information on this process is described in both the statewide PCB and mercury TMDLs.

A few instances exist where the EGLE has determined that assessment units do not support one or more designated uses, but other appropriate pollution control mechanisms are in place. These assessment units are placed in Category 4b. As described above, the pollution control mechanism for a Category 4b water body is expected to result in the attainment of the designated use within a practical timeframe. Considerations to determine if a pollution control mechanism is appropriate to place a water body in Category 4b include, but are not limited to: the scale of the project (e.g., geographic extent affected, duration, etc.) and the anticipated level of impact on water quality. The EGLE works closely with the USEPA to develop any new listings in Category 4b.

Assessment methodologies used for streams and rivers are also used for channelized streams, when appropriate, including rapid bioassessment of macroinvertebrate and fish communities according to the five-year rotating watershed cycle.

An assessment unit is listed in Category 4c when sufficient water quality data and information are available to determine all of the following:

- A specific designated use is not supported (e.g., the other indigenous aquatic life and wildlife designated use is not supported based on a P51 poor macroinvertebrate community rating).

- The cause of the designated use nonattainment is due to something other than a pollutant (e.g., channel maintenance activity or beaver dam).

- No pollutant would cause the designated use nonattainment if the above cause did not occur.

Assessment units are only placed in Category 4c when EGLE monitoring staff determines (using P51 or other appropriate techniques) that sufficient water quality data and information are available to clearly indicate that the Category 4c listing requirements explained in the preceding paragraph fully apply.

Key factors considered by EGLE monitoring staff to help differentiate whether pollutants or other causes are responsible for the observed nonattainment include: water/sediment chemistry and microbiological data when such data are available for the assessment unit, riparian land use characteristics, and P51 habitat metric scores, particularly those for the epifaunal substrate/available cover, embeddedness, sediment deposition, channel alteration, channel sinuosity, bank stability, bank vegetative protection, and riparian vegetative zone width metrics.

It should be noted that EGLE recognizes sediment to be a pollutant. If EGLE aquatic biologists determine that a pollutant (including riparian sediment) is responsible for an assessment unit not supporting a designated use, then that assessment unit is listed in Category 5. Additionally, if channel modification activities in an upstream assessment unit result in sedimentation problems in a downstream assessment unit to a point which causes a designated use to not be supported, then that downstream assessment unit is listed in Category 5.

Michigan uses a multiple category system; therefore, placement of an assessment unit in Category 4c based on a determination that a designated use is not supported and the cause is not a pollutant does not preclude placement of that assessment unit in Category 5 (or any other category) based on a designated use support determination for a different designated use.

Assessment units that do not support a designated use due to multiple causes may be listed in multiple categories for that designated use. For example, an assessment unit may have a TMDL completed for sedimentation; therefore, the assessment unit is listed in Category 4a for the other indigenous aquatic life and wildlife designated use. The same assessment unit may have a mercury TMDL scheduled but not yet completed; therefore, the assessment unit is also listed in Category 5 for the other indigenous aquatic life and wildlife designated use (see Table 3.3, Assessment Unit 10). In this case, the assessment unit is reported in both Categories 4a and 5 for the other indigenous aquatic life and wildlife designated use.

The following example (Table 3.3) adapted from USEPA guidance, illustrates Michigan's use of a multiple category system.

Table 3.3. Examples of assessment unit assignment to categories using a multiple category system with three designated uses. S = Supporting, NS = Not Supporting, - = Not Assessed, ? = Insufficient Information, / = Designated use does not apply to assessment unit.

	Designated use A	Designated use B	Designated use C	Assigned Categories
Assessment Unit 1	S	S	S	1
Assessment Unit 2	NS	NS	NS	5
Assessment Unit 3	S	S	-	2, 3
Assessment Unit 4	S	S	?	2, 3
Assessment Unit 5	S	-	?	2, 3
Assessment Unit 6	S	NS (nonpollutant)	S	2, 4c
Assessment Unit 7	S	?	NS	2, 3, 5
Assessment Unit 8	S	NS (nonpollutant)	/	2, 4c, 3*
Assessment Unit 9	-	NS (TMDL approved)	NS	3, 4a, 5
Assessment Unit 10	-	NS (TMDL approved) NS	-	3, 4a, 5

* Currently designated uses that do not apply to an assessment unit are assigned not assessed in ATTAINS (e.g., coldwater fishery).

Justification for designated use support determination for each assessment unit is contained in ATTAINS. A comprehensive list of designated use support determinations is provided in Appendix B.

3.12 Impairment Cause and Source

When a determination is made that a designated use is not supported (i.e., an assessment unit is placed in Category 4 or 5), the cause and source of impairment are identified. Generally, the cause of impairment is the parameter(s) used to determine that the designated use is not supported unless a biological indicator is used. The source of impairment is determined using supporting contextual information and BPJ.

In addition, sediment toxic substance concentration data may be used to support other assessment types to make support determinations for the other indigenous aquatic life and wildlife, fish consumption, or other designated uses. Sediment data are collected from water bodies when there is direct knowledge or reasonable expectation of heavy metal or organic chemical contamination at levels that may impair biological communities by direct toxicity or cause fish consumption problems. Contaminated sediments may be listed as the source of impairment when sediment pollutant concentrations exceed screening concentrations (MacDonald et al., 2000; Jones and Gerard, 1999; and Ontario Ministry of the Environment, 1993) or when sediment toxicity test results demonstrate excessive toxicity.

3.13 Delisting Category 5 Assessment Units

Assessment units are removed from the Section 303(d) list (i.e., moved from Category 5 to another category) by EGLE using representative data and the current assessment methodology. Data analysis used to remove an assessment unit from the Section 303(d) list must be at least as rigorous a data analysis as was originally used to list the water body. Specific instances that justify the removal of assessment units from Category 5 include:

- A TMDL has been developed for all pollutants and approved by the USEPA (assessment unit is placed in Category 4a).

- A corrective, remediation action plan has been approved to be implemented or the problem source(s) has been removed, thereby, eliminating the need for a TMDL (assessment unit is placed in Category 4b or when water quality is reevaluated and it is determined that the designated use is supported, the assessment unit is placed in Category 2 or Category 1).

- The source of impairment for the initial designated use support determination was an untreated CSO and updated information reveals that the untreated CSO has been eliminated or control plan elements have been implemented in a legally binding document that includes a schedule for elimination of the untreated discharge but data are not yet available to document restoration (assessment unit is placed in Category 3 unless the corrective action program has not yet been completed, then it is placed in Category 4b).

- Reassessment of the assessment unit using updated monitoring data or information, techniques, or WQS, indicates that the water body now supports the designated use (assessment unit is placed in Category 1 or Category 2).

- Reexamination of the monitoring data or information used to make the initial designated use support determination reveals that the decision was either incorrect or inconsistent with the current assessment methodology.

- Reassessment of a water body indicates that the cause of impairment is not a pollutant (assessment unit is placed in Category 4c).

- The assessment unit is determined to be within Indian Country, as defined in 18 U.S.C., Section 1151. These water bodies are not considered waters of the state of Michigan, and therefore, are not appropriate to include on the Section 303(d) list.

3.14 Assessment Methodology Changes

In addition to the minor edits and clarification changes made to update the 2016 assessment methodology for the 2018 IR, the following updates were made under the noted Sections:

3.2 & 3.6.1.1 - Expansion of the data window used for WCMP program data to 7 years to potentially capture 2 cycles of data within a review period thereby providing better supporting information on conditions over time. Revisions were made to Figures 3.3a and b to reflect this change.

*3.6.2.3 - Sediment toxicity m*ethodology was added as an indicator to make support determinations for the Other Indigenous Aquatic Life and Wildlife designated use based on sediment toxicity data in combination with other supporting information, in part following past comments received from the public.

3.9.1.4 - Nitrates was added as an indicator to the Public Water Supply designated use to clarify the methodology that has been used for this parameter and in response to comments received from the USEPA.

3.9.1.5 - Total Microcystins was added as an indicator to the Public Water Supply designated use based on comments received from, and coordination with, SDWA staff within EGLE's Drinking Water and Environmental Health Division.

CHAPTER 4
ASSESSMENT RESULTS: THE GREAT LAKES, BAYS, CONNECTING CHANNELS (ST. MARYS, ST. CLAIR, AND DETROIT RIVERS), AND LAKE ST. CLAIR

4.1 Trophic Status

Overall phosphorus loading reductions in the Great Lakes are attributable, in part, to effluent nutrient limits in NPDES permits issued to municipal and industrial facilities. For Great Lakes protection, Michigan's WQS restrict point source discharges of phosphorus to 1 milligram per liter (mg/L) as a maximum monthly average. Lower limits may be, and often are, imposed to protect designated uses in receiving or downstream waters.

Legislation passed in 1977 that reduced the allowable phosphorus content in household laundry detergents sold in Michigan to less than 0.5% phosphorus by weight has contributed to the reduction of phosphorus discharged from point sources. Legislation passed in 2009 reduced the allowable phosphorus content in any cleaning agent sold in Michigan intended for use in household clothes washing machines and, beginning July 1, 2010, dishwashers to 0.5% by weight expressed as elemental phosphorus. This legislation has the effect of further reducing phosphorus loads from wastewater treatment plants and on-site treatment systems. NPS phosphorus reduction efforts continue and are aided by legislation that went into effect in 2012 banning the use of phosphorus-containing lawn fertilizers. The current trophic status of each of Michigan's Great Lakes is presented in Table 4.1.

Table 4.1 Trophic status of the Great Lakes bordering Michigan.

Lake	Trophic Status (nutrient level)
Superior	Oligotrophic* (low)
Huron	Oligotrophic* (low)
Saginaw Bay	Eutrophic† (high)
Michigan	Oligotrophic* (low)
Erie (Central Basin)	Oligotrophic/mesotrophic* (moderate)
Western Basin	Mesotrophic* (moderate)

*USEPA, 2015; †USEPA, 2011b

4.2 Water Chemistry of the Great Lakes Connecting Channels

Quality assured data through 2015 were used for assessment updates for this reporting cycle. Refer to earlier reporting cycles (MDEQ, 2016) for discussions of broader trends and results around Michigan as analyzed in the 2013 WCMP report (MDEQ, 2013b).

4.3 Water Chemistry of Saginaw Bay and Grand Traverse Bay

Quality assured data through 2015 were used for assessment updates for this reporting cycle. Refer to earlier reporting cycles (MDEQ, 2016) for discussions of broader trends and results around Michigan as analyzed in the 2013 WCMP report (MDEQ, 2013b).
Saginaw Bay and Grand Traverse Bay monitoring efforts continue and will continue to be summarized in reports with connecting channels (see Section 4.2) and rivers and streams (see Section 6.2), every 3-5 years.

4.4 Fish Contaminants

Several projects have been implemented in the Great Lakes basin to monitor temporal and spatial trends in fish contaminant levels:

- The USEPA, Great Lakes National Program Office, collects and analyzes whole lake trout from the open waters of Lakes Superior, Michigan, Huron, and Ontario, and walleye from Lake Erie.

- Michigan's whole fish contaminant trend monitoring effort, initiated in 1990, focuses on fish collected from ten fixed stations located in the Great Lakes bays and connecting channels.

In addition, edible portion fish tissue contaminant monitoring was conducted in 2014 in Little Bay De Noc (northern Lake Michigan), Saginaw Bay and Thunder Bay (Lake Huron), and the St. Marys River. In 2015 edible portion samples were collected from Grand Traverse Bay (Lake Michigan) and the Detroit River. Fish tissue samples from top predators in these water bodies all had elevated mean mercury concentrations indicating the fish consumption designated use was not supported. In addition, PCBs and dioxins cause restricted consumption advisories for certain species of gamefish. Edible portion sampling is often targeted toward known sites of contamination, sites popular with sport anglers, and sites with public access.

4.5 Beaches

In 2015, 203 public beaches (owned by a city, county, etc.) on the Great Lakes were monitored and 138 reported no exceedances of the *E. coli* WQS for total body contact. There were 65 beaches that reported a total of 142 exceedances.

In 2016, 209 public beaches were monitored and 166 reported no exceedances of the *E. coli* WQS for total body contact. There were 43 beaches that reported a total of 114 exceedances.

The Michigan Beach Web site (https://www.egle.state.mi.us/beach/) provides access to a database containing beach closings and *E. coli* data collected by local health departments (LHD) and annual reports summarizing the data. Currently, 614 public beaches located along the Great Lakes are listed in the database; although, water quality data are not available for all beaches. Data for Great Lakes beaches in Michigan are also available at http://watersgeo.epa.gov/beacon2/.

Since 2012, EGLE has been sampling water, including the algal toxin microcystin, and documenting beach conditions at seven beaches along the Michigan shoreline of western Lake Erie to investigate possible Harmful Algal Bloom impacts and other nutrient-related effects (e.g., nearshore attached algae, beach/shoreline 'muck'). Similar efforts were undertaken at

4 Saginaw Bay beaches starting in 2016 to better understand the geographic scope, frequency, and duration of possible nutrient-related impacts to the bay and its shoreline areas.

4.6 Decaying Organic Matter Deposits

Deposits of dead and decaying organic matter continue to periodically foul beaches along Michigan's Great Lakes shoreline including, but not limited to, Grand Traverse Bay, Saginaw Bay, and western Lake Erie, as well as along portions of Michigan's Lake St. Clair shoreline. While increased aquatic vegetation growth is typically associated with elevated nutrient concentrations, many of the shoreline deposits are occurring where ambient phosphorus and nitrogen concentrations are very low or declining. Similar problems are being reported along the Wisconsin Lake Michigan shoreline, the Ohio and Pennsylvania Lake Erie shoreline, and the New York Lake Ontario shoreline, where, like Michigan, shorelines are being fouled by decaying organic matter that may interfere with the enjoyment of beaches and nearshore waters.

Once thought to be caused primarily by the presence of excessive nutrients (phosphorus), there is growing evidence that the increased organic matter deposits may be the result of a complex interaction between nutrients and exotic mussel species (Hecky et al., 2004), the expanding range of filamentous benthic cyanobacteria (e.g., *Lyngbya wollei*) (Bridgeman and Penamon, 2010), changes in wind patterns over the Great Lakes (Waples and Klump, 2002), and fluctuating water levels (Harris, 2004). Research is ongoing to identify the causes and sources for these shoreline deposits with the hope that effective solutions can be found, although indications are that ecosystem shifts based on invasive and nuisance species and climate changes means effective control on a meaningful scale will be difficult. While phosphorus concentrations do not appear to be solely responsible for the shoreline deposits, programs and policies intended to reduce phosphorus in all waters of the state remain important components of efforts to improve and protect water quality.

4.7 Lake Erie Support Summary

Widespread and persistent cyanobacteria blooms in the western basin of Lake Erie continue to affect related designated uses in Michigan's portion of the lake. In 2016 the other indigenous aquatic life and wildlife use was listed as impaired based on repeated, persistent, and extensive cyanobacteria blooms indicating excessive/nuisance nutrient conditions leading to ecological imbalance. Similarly, data used in this 2018 review supports an impairment designation for the public water supply use in portions of Lake Erie, which are critical assessment zones for drinking water intakes, following the relevant assessment methodology (Chapter 3, Section 3.9.1.5). Raw source water monitoring data showing the presence of microcystins above USEPA's drinking water guidance values indicates that, without proper treatment and an increased use of technological solutions, the source water of Lake Erie would not be suitable for consumption.

It is important to note that this impairment designation relates to the source water quality only and has no direct relevance to the quality of finished drinking water supplied by treatment systems under the Safe Drinking Water Act. With technological advances and additional treatment, facilities withdrawing drinking water from Lake Erie continue to provide high-quality finished drinking water; this impairment designation serves to recognize impairments to source water quality that necessitate treatment upgrades and increased costs as the result of water quality degradation.

The significance of the cyanobacteria bloom issue in Lake Erie is evidenced by the Great Lakes Water Quality Agreement Annex 4 (Nutrients) workgroup, including representatives from the State of Michigan, focusing first and foremost on the Lake Erie issues of algal community imbalance, cyanotoxins, hypoxia, and maintenance of trophic conditions. There is broad agreement that excessive nutrients are the primary cause, from a pollutant perspective, of these changes to Lake Erie's ecosystem. As such, total phosphorus has been identified as the target nutrient for necessary reductions, with the acknowledgement that other relevant nutrients (particularly bioavailable phosphorus forms and nitrogen sources) will also be reduced concomitantly.

The Annex 4 Objectives and Targets Task Team was charged with identifying target reductions to achieve a level of algal growth that supports a healthy and productive Lake Erie, acknowledging that the complete elimination of algae is not in keeping with a healthy aquatic ecosystem. Load reductions were set using the 2004 and 2012 cyanobacteria blooms as the targets at, or below which, future blooms should be maintained 90% of the time. Similarly, it is anticipated that success at eliminating nuisance cyanobacteria bloom conditions will be demonstrated within Michigan waters of Lake Erie based on evaluation of future conditions aligning with the goals identified by the Task Team.

The Annex 4 Objectives and Targets Task Team Final Report (May 11, 2015) went through a significant deliberative process to identify sources and loading estimates of total phosphorus to Lake Erie. Based on these goals, the subcommittee set the load targets of 40 percent reductions in total phosphorus entering the western basin, including, and of particular relevance for Michigan, a 40 percent reduction in spring total and soluble reactive phosphorus (SRP) from the River Raisin, and a 40 percent reduction in spring SRP from the Maumee River, some headwaters to which are in Michigan. The 40 percent reduction of total phosphorus loads to Lake Erie are expected to be met by 2025, with an interim goal of 20 percent reduction by 2020, as stated in the Western Basin of Lake Erie Collaborative Agreement signed in June 2015 by Michigan's Governor Rick Snyder with Premier Kathleen Wynne of the Province of Ontario and Lieutenant Governor Mary Taylor of Ohio.

The MDARD and MDNR are actively working alongside EGLE to address the algae blooms and nutrient loading to western basin of Lake Erie. Plans from the three state agencies are merged into Michigan's 2018 Domestic Action Plan which, when considered with Domestic Action Plans from other states and Canada, establishes a road map for addressing this problem.

Because of the complexity of the cyanobacteria bloom problem Michigan continues to believe the best approach for solving the issues in western Lake Erie is through the collaborative process established under Annex 4 of the Great Lakes Water Quality Agreement and the Western Basin of Lake Erie Collaborative Agreement as they afford a holistic, multi-jurisdictional perspective that does not exist in a traditional TMDL process. Nonetheless, if the current collaborative processes fail to restore designated use support we recognize that a TMDL or other approach allowed by the USEPA to address impaired waters under the CWA will be required.

Michigan's TMDL schedule is aligned with the TMDL vision process described in Section 8.3.3 and Michigan's 2015 TMDL vision identifies TMDL expectations through 2022. The TMDL vision process will continue in 2022 by establishing the next series of priorities for Michigan's TMDL program; part of this next prioritization will be the evaluation of progress under the collaborative agreements related to Lake Erie. Michigan remains strongly committed to reducing phosphorus loadings to western Lake Erie as outlined in the Domestic Action Plan noted above.

CHAPTER 5
ASSESSMENT RESULTS: INLAND LAKES AND RESERVOIRS

5.1 Trophic Status

Carlson's TSI is used by EGLE to assess and classify Michigan's 730 public access lakes (see Section 1.2.2). This classification system is based on an index derived from a combination of four field measurements: (1) summer Secchi depth (transparency); (2) total phosphorus concentration (epilimnetic); (3) chlorophyll *a* concentration (photic zone), and (4) macrophyte abundance. The numerical value of the index increases as the degree of eutrophication increases. Historically, inland lake monitoring efforts have been directed toward obtaining baseline data for all 730 public access lakes.

The EGLE and USGS completed a cooperative project in 2010 that sampled 730 public access inland lakes greater than 25 acres as part of the Lake Water Quality Monitoring Assessment Project. The majority (72%) of Michigan's public access lakes that were sampled from 2001 through 2010 have moderate (mesotrophic) or low (oligotrophic) nutrient levels (Table 5.1) (Fuller and Taricska, 2012).

Table 5.1 Trophic status summary of Michigan's public access lakes sampled from 2001 through 2010 (N=730).

Trophic Status	Number of Lakes
Oligotrophic (low nutrients)	129 (18%)
Mesotrophic (moderate nutrients)	399 (54%)
Eutrophic (high nutrients)	174 (24%)
Hypereutrophic (excessive nutrients)	28 (4%)

During 2015 and 2016, over 200 lakes were sampled each year as part of the Cooperative Lakes Monitoring Program, under the Michigan Clean Water Corps (for additional information see http://www.micorps.net). During 2015, 128 of these lakes were sampled for the three primary trophic status indicators (Secchi depth, total phosphorus, and chlorophyll *a*). Of these lakes, 49 were classified as oligotrophic, 64 mesotrophic, and 15 eutrophic. During 2016, 119 lakes were sampled for all three primary trophic status indicators and 50 were classified as oligotrophic, 58 mesotrophic, and 11 eutrophic.

5.2 Fish Contaminants

In 1990, Michigan initiated a fixed station fish contaminant trend monitoring project to measure spatial and temporal trends of certain bioaccumulative contaminants. Adult fish are collected from each site at a target interval of two to five years, and analyzed as whole fish samples. Fish have been collected from seven inland lakes (Gogebic, South Manistique, Higgins, Houghton,

Gun, Gull, and Pontiac) as part of the fish contaminant trend monitoring project. Whole fish fixed station trend monitoring data collected since 1990 were reviewed and general trend conclusions for inland lakes are summarized below:

- Lindane, terphenyl, PBB, heptachlor, and aldrin were quantified only rarely in the fish sampled. However, heptachlor epoxide and dieldrin (breakdown products of heptachlor and aldrin) were quantified in most of the samples analyzed.

- In addition to heptachlor epoxide and dieldrin, several chemicals were quantified in fish consistently, indicating that they are ubiquitous in the aquatic environment. These include mercury, hexachlorobenzene, total PCB, total chlordane, and total DDT.

- Fish from inland lakes tended to have higher concentrations of mercury than the same species from the Great Lakes or connecting channels.

- Total PCB concentrations declined at all of the inland lake trend sites monitored between 1990 and 2015, with an average decline of 8% per year.

- Total DDT concentrations declined at all of the inland lake trend sites monitored between 1990 and 2015, with an average decline of 7% per year.

- Total chlordane concentrations declined at all of the inland lake trend sites monitored between 1990 and 2015 where a trend could be detected, and the average decline was 8% per year. No trend was detected at 2 inland lakes because chlordane concentrations were consistently below the analytical quantification level.

- Significant trends in mercury concentrations have been detected at 4 of the 7 inland lake trend sites. Mercury concentrations in walleye from Lake Gogebic declined 2% per year between 1991 and 2015, declined in largemouth bass from Gull Lake at a rate of 2% per year between 1991 and 2015, while increasing in South Manistique Lake walleye by 1% per year between 1991 and 2015 and 4% per year in lake trout from Higgins Lake between 1991 and 2015.

In addition, edible portion fish tissue contaminant monitoring was conducted in 2014 and 2015 at 26 inland lakes and 19 reservoirs. Edible portion sampling is often targeted toward known sites of contamination, sites popular with sport anglers, and sites with public access. Results of the edible portion monitoring are used by EGLE in determining the status of the Fish Consumption designated use for a given water body. A total of 30 inland water bodies monitored in 2014 and 2015 were assessed as not supporting the Fish Consumption designated use. The edible portion fish tissue results are also used by the MDHHS to update fish consumption advisories.

5.3 Beaches

In 2015, a total of 178 public beaches (owned by a city, county, etc.) on inland lakes were monitored and 149 had no exceedances of the *E. coli* WQS for total body contact. There were 29 beaches that reported a total of 66 exceedances.

In 2016, a total of 200 public beaches on inland lakes were monitored and 167 had no exceedances of the *E. coli* WQS for total body contact. There were 32 beaches that reported a total of 69 exceedances.

The Michigan Beach Web site (https://www.egle.state.mi.us/beach/) provides access to a database containing beach closings and *E. coli* data collected by LHDs and annual reports summarizing the data. Currently, 564 public beaches located on inland lakes are listed in the database; although, not all beaches are monitored.

CHAPTER 6
ASSESSMENT RESULTS: RIVERS

6.1 Biological Integrity

All available biological assessments (e.g., fish and macroinvertebrate communities, targeted and probabilistic study designs) are evaluated using the assessment methodology (Chapter 3) and potentially used to determine designated use support. As part of EGLE's water quality monitoring program, sites are selected using both targeted and probabilistic study designs to assess the biological integrity of rivers and streams using macroinvertebrate communities. Procedure 27 (MDEQ, 2015) is used to estimate the number of river miles supporting the other indigenous aquatic life and wildlife designated use. Results are available for watersheds monitored in 2010 through 2014 (draft data)). Results from the 2010 through 2014 cycle were combined to determine a statewide designated use support status estimate of 95% for the other indigenous aquatic life and wildlife designated use in Michigan rivers and streams. Results from this project will also be used to assess temporal trends in biological integrity.

6.2 Water Chemistry

EGLE and its partners collect water samples from many rivers and streams throughout the state as part of the WCMP and other special studies and analyze them for a variety of parameters. Quality assured data through 2015 were used for assessment updates for this reporting cycle. Refer to earlier reporting cycles (MDEQ, 2016) for discussions of broader trends and results around Michigan as analyzed in the 2013 WCMP report (MDEQ, 2013b).

6.3 Fish Contaminants

In 1990, Michigan initiated a fixed station fish contaminant trend monitoring project to measure spatial and temporal trends of certain bioaccumulative contaminants. Adult fish are collected from each site at a target interval of two to five years and analyzed as whole fish samples. Carp were collected periodically from five river impoundment trend monitoring sites since 1990. These sites were located on the Muskegon, Grand, Kalamazoo, St. Joseph, and Raisin Rivers. Whole fish fixed station trend monitoring data collected between 1990 and 2015 were reviewed and general trend conclusions for rivers are summarized below:

- Lindane, terphenyl, PBB, heptachlor, and aldrin were quantified only rarely in the fish sampled. However, heptachlor epoxide and dieldrin (breakdown products of heptachlor and aldrin) were quantified in most of the samples analyzed.

- In addition to heptachlor epoxide and dieldrin, several chemicals were quantified in fish consistently, indicating that they are ubiquitous in the aquatic environment. These include mercury, hexachlorobenzene, total PCBs, total chlordane, and total DDT.

- Average total PCB concentrations were highest in carp from the Kalamazoo River site. The Kalamazoo River has extensive areas of PCB contaminated sediments, a problem that is being addressed under state and federal programs.

- Total PCB concentrations declined at all 5 river trend sites, with an average decline of 7% per year between 1990 and 2015.

- Total DDT concentrations declined at all but 1 river trend site, with an average decline of 8% per year between 1990 and 2015. The exception was the Grand River site (6th Street Dam impoundment in Grand Rapids) where no trend in DDT in carp was detectable between 1990 and 2014.

- Total chlordane concentrations declined at all 5 river trend sites, with an average decline of 7% per year between 1990 and 2015.

- Mercury concentrations decreased 3% per year in fish from the River Raisin. No significant trends in mercury concentration were measured in the Grand, Kalamazoo, Muskegon, or St. Joseph Rivers.

Edible portion fish tissue contaminant monitoring was conducted in 2014 and 2015 in 7 rivers. Edible portion sampling is often targeted toward known sites of contamination, sites popular with sport anglers, and sites with public access. Results of the edible portion monitoring are used by EGLE in determining the status of the Fish Consumption designated use for a given water body and by the MDHHS to update the fish consumption advisories. Of the 7 locations monitored in 2014 and 2015, 6 were assessed as not supporting the Fish Consumption designated use; there was insufficient information for one site (Tahquamenon River mouth) to make a determination.

6.4 Microorganisms

In 2015, a total of 6 public beaches on rivers were monitored and 4 reported no exceedances of the *E. coli* WQS for total body contact. There were 2 beaches that reported a total of 4 exceedances.

In 2016, a total of 8 public beaches on rivers were monitored and 5 reported no exceedances of the *E. coli* WQS for total body contact. There were 4 beaches that reported a total of 5 exceedances.

The Michigan Beach Web site (https://www.egle.state.mi.us/beach/) provides access to a database containing beach closings and *E. coli* data collected by LHDs. Currently, 71 public beaches located on rivers are listed in the database.

In 2015 and 2016, EGLE monitored 66 river sites across the state, including tributaries in the Kalamazoo, Macatawa, St. Joseph, Muskegon, Shiawassee, Cass, Tiffin, Raisin, and Ottawa-Stony watersheds. An additional 125 riverine sites were monitored by conservation districts, health departments, colleges, and local organizations; including portions

of the Pine (Alma, Michigan), Looking Glass, Misteguay, Maple, and Grand Rivers. Based on this monitoring an additional 2,700 miles exceeded the *E. coli* WQS for total body contact. One previously impaired stream, Frechette Creek (5 miles) a tributary to the St. Marys River, was monitored and shown to be meeting the *E. coli* WQS for total body contact. Frechette Creek is part of the Sault Ste. Marie Area Tributaries *E. coli* TMDL and is now fully supporting the total body contact designated use.

CHAPTER 7
ASSESSMENT RESULTS: WETLANDS

7.1 Designated Use Support Summary

Michigan's WQS apply to all surface waters of the state, including wetlands. However, some criteria may not be applicable to wetlands. For example, a highly productive wetland with abundant vegetation in shallow water and high organic content in the sediment may naturally exhibit low dissolved oxygen levels in the water column. Based on Rule 100(10) of the WQS, use attainability studies are allowed for certain wetlands to address this situation.

Michigan's wetlands are currently assessed for designated use support on an as needed basis. Michigan uses a multiple category system (i.e., assessment units may be placed in one or more category, see Section 3.11); therefore, wetland acres are not totaled. Details regarding the five listed wetlands follow.

- A small wetland area in the Grand River watershed (0.25 acres in Jackson County) is listed as having insufficient information to determine if the other indigenous aquatic life and wildlife designated use is supported due to point sources discharges and contaminated groundwater.

- Tobico Marsh (Bay County), a 680-acre marsh adjacent to Saginaw Bay, is not supporting the fish consumption designated use due to elevated PCB concentrations in carp and northern pike populations. Carp and northern pike were collected and analyzed between 2007 and 2012. These new data did not result in a change to the fish consumption advisory.

- Ruddiman Creek Lagoon (21 acres in Muskegon County) is not supporting the fish consumption, and total and partial body contact recreation designated uses. This wetland was the subject of a major sediment remediation project completed in 2006 that involved the removal of approximately 86,000 cubic yards of sediments contaminated with PCBs, metals, and polynuclear aromatic hydrocarbons.

- Clark's Marsh (Iosco County), a 420-acre marsh adjacent to the Au Sable River, is not supporting the fish consumption designated use due to elevated PFOS in bluegill and pumpkinseed sunfish sampled in 2011. This marsh is adjacent to the former Wurtsmith Air Force Base, an area of which was used regularly for fire suppression training with fire-fighting foams containing perflourinated compounds.

CHAPTER 8
WATER BODIES NOT SUPPORTING DESIGNATED USES AND CWA SECTION 303(D) REQUIREMENTS

8.1 Introduction

The purpose of this chapter is to provide additional information regarding water bodies that are determined to not support one or more designated uses (i.e., water bodies that are listed in Categories 4 or 5; see Section 3.11 for a description of the categories). Section 303(d) of the CWA and the USEPA's Water Quality Planning and Management Regulations (40 CFR, Part 130) require states to develop TMDLs for water bodies that are not meeting WQS (i.e., water bodies that are listed in Category 5). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point sources and NPS to restore and maintain the quality of their water resources.

8.2 Impairment Cause and Source

When a determination is made that a designated use is not supported (includes both Categories 4 and 5), the cause and source (when known) of impairment is identified (see Section 3.12). Each assessment unit may be listed for one or more causes and sources of impairment. Summary information on causes and sources statewide are not currently available but are expected to be readily available at multiple scales (from statewide down to local subwatershed) from the USEPA's How's My Waterway Web site, which is under current redesign and expected to be released in 2019. See Section 1.1 for additional information.

8.3 TMDL Development

8.3.1 The TMDL Process

Michigan's Section 303(d) list consists of assessment units that are listed in Category 5. A TMDL is developed for each cause (see Section 8.2) or a TMDL may address more than one related cause.

Development of a TMDL is typically preceded by collection of water quality data by EGLE or its contractors to document current pollutant loads within the water body of concern and further define potential sources of the pollutant. These data, in addition to any other relevant information, form the basis for determining the necessary pollutant load reductions. A TMDL document is comprised of several sections including identification of the impaired assessment unit and cause of impairment, description of water quality studies conducted to identify the extent and source(s) of the impairment, and calculation of necessary load reductions for the

point source and NPS to achieve WQS. The TMDL also identifies any past, current, or future known actions to remedy the impairment and a monitoring schedule to track improvements following implementation of the TMDL.

The TMDL document is typically developed by staff members of EGLE. The draft document is made available for public review on EGLE's Web site for at least 30 days. The announcement for the public comment period is published in the EGLE calendar. During the public comment period, EGLE staff normally hold a public meeting in a community near the impaired water body to describe the TMDL and receive comments. Local stakeholders, including the general public, LHDs, local government, and county extension officials are sought to attend the meetings to contribute their expertise in identifying pollutant sources and discuss source reduction/elimination. Following the comment period, the TMDL is modified as appropriate to address comments received.

The TMDL is finalized following the public comment period and submitted to the USEPA, Region 5, for their review and approval. The USEPA has 30 days to review and approve or disapprove a TMDL. After a TMDL is approved by the USEPA, the water body is removed from the Section 303(d) list (Category 5) and reclassified as Category 4a. For additional information regarding delisting Category 5 assessment units see Section 3.13.

8.3.2 TMDLs Completed

In 2014, the EGLE shifted the TMDL focus from the strict pace requirements to the newly-developed Long-term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program. The EGLE developed an approach to TMDL prioritization for the 2016-2022 time period. In 2017 the EGLE statewide PCB TMDL was approved by USEPA. Similarly, in 2018 the USEPA approved the statewide mercury TMDL. Additional TMDLs submitted and approved since the 2016 IR include: Ox Creek Sediment/Biota TMDL (approved by the USEPA in 2018), Bad Axe Creek *E. coli* and Phosphorus TMDL (with USEPA contract support; approved by the USEPA in 2016)

Although not completed at the time of this report, significant progress has been made on the statewide *E. coli* TMDL. Additional information regarding approved TMDLs is available at http://www.michigan.gov/deqwater under Lakes & Streams, Surface Water, Assessment of Michigan Waters, TMDLs.

8.3.3 TMDL Schedule per Michigan's 2016-2022 Prioritization Framework for the Long-Term Vision for Assessment, Restoration, and Protection Under the Clean Water Act Section 303(d) Program

In December 2013, the USEPA announced the "Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program" (TMDL Vision). The TMDL Vision includes six goals: Engagement, Prioritization, Protection, Integration, Alternatives, and Assessment. An evaluation of the accomplishments of the TMDL Vision's goals is to be completed in 2022.

"Prioritization" is defined by the TMDL Vision as a systematic approach developed by individual states to prioritize watersheds or waters for TMDL development, restoration, and protection for incorporation into the 2016 Integrated Report. Once a state identifies its priorities, it will be expected to address all of them between 2016 and 2022 through a combination of TMDLs,

alternative approaches, program integration, public engagement improvements, and protection activities. In keeping with this approach, priorities identified in the TMDL Vision document will be assigned a TMDL date of 2022, signifying their anticipated completion by the end of 2022. Similarly, those TMDLs that were not identified as a priority in this first TMDL Vision document will be assigned a TMDL date of post-2022 (denoted as > '22 in ATTAINS), signifying their reevaluation for prioritization during the next TMDL Vision review process. The full TMDL Vision document can be found in Appendix F of the 2016 IR, available electronically at http://www.michigan.gov/deqwater under Lakes and Streams, Surface Water, Assessment of Michigan Waters, Water Quality and Pollution Control in Michigan Sections 303(d), 305(b), and 314 Integrated Report. This document was submitted by the EGLE and agreed upon by USEPA Region 5 in September 2015.

In the past, Michigan did not prioritize TMDLs based solely on watershed location, cause, or pollutant. When a water body was identified as impaired, it was added to the TMDL schedule with a goal of completing a TMDL within 13 years of the first listing (per USEPA guidance). The TMDL schedule published in the 2014 IR ran through 2031. In contrast, the TMDL Vision approach focuses less on TMDL production and more on how the Section 303(d) Program can support water quality objectives of Michigan. Therefore, the TMDL Vision allows the opportunity to better align TMDL priorities with WRD priorities.

In 2009, the WRD identified five major goals to define aspects of this mission: (1) Enhance Recreational Waters; (2) Ensure Consumable Fish; (3) Protect and Restore Aquatic Ecosystems; (4) Ensure Safe Drinking Water; and (5) Protect Public Safety. For each goal, measurable outcomes (measures of success) are identified. The 2016 TMDL Vision priorities are linked to these goals and measures of success to ensure better engagement and integration with other WRD programs. The 2016 TMDL Vision priorities are summarized below and described more fully along in Appendix F of the 2016 IR, available as noted above.

8.3.3.1 Statewide Pathogen TMDL

Michigan has 615 public beaches on the Great Lakes and connecting channels, 602 inland lake beaches, and over 1,400 publicly maintained boat launches making our waters accessible to everyone. Michigan also has over 76,000 miles of rivers, almost 900,000 acres of inland lakes and reservoirs, and over 40,000 square miles of Great Lakes and bays (including Lake St. Clair), all of which are designated for Total Body Contact recreation from May 1 through October 31 and for Partial Body Contact Recreation year-round. Michiganders and EGLE are proud of their beautiful beaches and care about water quality and keeping the people of Michigan and our visitors safe while recreating in Michigan's waters.

EGLE has worked toward achieving its priority goal of clean beaches for recreation through an extensive investment of resources. However, in 2013, the EGLE estimated that 48 percent of the rivers and streams exceed the Total Body Contact Recreation designated use and 20 percent of monitored beaches have had closures due to bacterial pollution (MDEQ, 2014). To help attain the goal of enhancing recreational waters and tie together the efforts that Michigan continues to expend on reducing *E. coli* contamination of surface waters, EGLE has made it a priority to develop a pathogen TMDL that will address all waters impaired by *E. coli.*

This TMDL will identify waters where action is needed, set an *E. coli* concentration target based on protecting the Total and Partial Body Contact Recreation designated uses, and identify needed pollutant reductions in all waters that are not meeting these designated uses. The statewide *E. coli* TMDL will apply to impaired waters only, including inland lakes, rivers, and

streams, beaches, and the Great Lakes.

In 2014, pathogen TMDLs were scheduled to be developed annually in Michigan for the next 17 years. The statewide *E. coli* TMDL will eliminate the need for numerous individual watershed-based *E. coli* TMDLs and the associated repetitive paperwork burden, long wait periods, and staff time spent on TMDL development. A statewide TMDL will save EGLE a significant amount of resources that would have been spent writing watershed-based TMDLs, while providing a faster path to implementation. For example, we can accelerate water quality restoration through implementation in NPDES permits, particularly MS4 permits, by more than a decade. Interested stakeholders can be assisted with source assessment, monitoring, and restoration solutions in their watershed to provide more site-specific information to enhance TMDL implementation at the local level. In these ways, our statewide *E. coli* TMDL aligns with the purpose of the USEPA's TMDL Vision, which emphasizes a path to better implementation of the Clean Water Act Section 303(d) program, water quality restoration, and coordination of water programs.

8.3.3.2 Statewide Mercury TMDL

Reducing human and wildlife exposure of mercury is also a priority in Michigan. The Michigan Department of Community Health continues to issue general fish consumption advisories and guidelines for all inland lakes in Michigan, and specific recommendations for Lakes Huron, Michigan, and Superior, and several hundred miles of rivers and streams due to mercury concentrations in fish tissue. Because of the widespread impairment of Michigan's waters due to mercury, a statewide TMDL approved in 2018 for inland waters primarily impacted by atmospheric deposition of mercury included needed mercury reductions from air sources and water dischargers to protect and restore inland waters.

8.3.3.3 Additional TMDL Activities per Michigan's Vision

In addition to the statewide *E. coli*, Mercury, and PCB TMDLs, the following TMDLs will be submitted for USEPA approval prior to 2022 as part of Michigan's TMDL Vision.

- Grand River/Red Cedar River Dissolved Oxygen TMDL.
- Trap Rock River and Owl Creek Copper TMDLs.
- Cass River watershed *E. coli* TMDLs. (Already public noticed and complete, but not submitted) It is expected that work to reduce *E. coli* will also result in reducing levels of nutrients and sediment entering surface waters, since many best management practices designed to mitigate sources of *E. coli* may also remove other pollutants.)

Michigan's Section 303(d) list, including assessment unit information and TMDL year, is presented in Appendix C.

8.3.4 Changes to the Section 303(d) List

The 2018 Section 303(d) list is provided in Appendix C. This list reflects the deletion and addition of assessment units or causes of impairment since the 2016 IR. Section 303(d) delisted assessment units may or may not support designated uses. For example, it may have been determined that the assessment unit is not supporting one or more designated uses but a TMDL is not required, or a cause of impairment may have been removed but a TMDL is still required to address a different cause of impairment. A brief delisting reason is provided in

Appendix D1. Deletions and additions to the Section 303(d) list are presented in Appendix D1 and D2, respectively

CHAPTER 9
PUBLIC PARTICIPATION IN THE IR

9.1 Introduction

EGLE provides opportunities for public participation in the development of the IR. The following information is a summary of those opportunities, the comments or information received from the public, and EGLE's response.

9.2 Request for Data

EGLE's, WRD, requested ambient water quality data (chemical, biological, or physical) that was obtained by other governmental agencies, nongovernmental organizations, or the public for Michigan surface waters since January 1, 2015. All water quality data submitted to the EGLE, WRD, before April 21, 2017 was evaluated according to the EGLE's assessment methodology (see Chapter 4) and potentially used to help prepare this IR. This request was published on the EGLE's calendar on March 6, March 20, April 3, and April 17, 2017, and e-mailed to key individuals in the MDNR's Fisheries Division, MDARD-Right to Farm, United States Forest Service, USFWS, University of Michigan, Alliance for the Great Lakes, and the USEPA. Additionally, an e-mail was sent via EGLE list-serve to over 1,600 members with specific interest in the Integrated Report and TMDL programs. Data were received from the following organizations: MDNR, Little River Band of Ottawa Indians, City of Rochester Hills, National Park Service, Three Lakes Association, The Watershed Center Grand Traverse Bay, Gogebic-Iron Wastewater, and Macomb County, Environmental Health Services Division. Table 9.1 summarizes whether these outside data were used, if so, how, and, if not, why.

9.3 Public Notice of Draft Assessment Methodology

A draft version of Chapter 3, the assessment methodology, was made available on EGLE's Web site for public review and comment. This announcement was published on EGLE's calendar on June 12, June 26, and July 10, 2017. Public comments to be considered in the development of Chapter 4 were due July 14, 2017. One public comment on the draft assessment methodology was received. Additionally, comments on the draft assessment methodology were received from the USEPA; comment summaries and responses are presented below. All comments received are included in their entirety in Appendix E.

Comment #1:

MWRA objects to other groups performing certified and "qualifying" testing that would be included to establish a TMDL. If groups wish to participate their time and efforts, their contributions should be used as preliminary information only. The Department should then follow up with their own personnel to confirm testing to substantiate any previous testing by volunteer groups. (Steve Essling, Michigan Waste and Recycling Association)

EGLE Response:

It is EGLE's current Assessment Methodology to use all data submitted to us for consideration after conducting a review of the quality assurance protocols, site locations, sample collection, and handling procedures. A quality assurance project plan detailing quality assurance is the best way to document that protocols are in compliance with scientific standards. If data meet acceptable quality control, and the monitoring locations suitably represent overall water quality, then EGLE typically will use it to assess designated use attainment. The use of this externally collected data allows EGLE to make good use of our resources, and the resources of local agencies such as conservation districts, our water quality monitoring grantees, health departments, and watershed councils. In doing so, the process also increases public engagement in solving problems to which everyone contributes to some degree.

Table 9.1 Summary of outside data received and their use in the 2018 IR.

Organization	**Data Used?**	**How (if Yes or Partial), Why (if No)**
City of Rochester Hills	No	A, B; E. coli single samples not usable
DNR Fish Data	Yes	Data reviewed and used to update relevant AUIDs
Gogebic-Iron Wastewater	No	B; Not ambient surface water data
Little River Band of Ottawa Indians	Yes	Data reviewed and used to update relevant AUIDs
Macomb County	No	A; E. coli single samples not usable
National Park Service	Yes	Data reviewed and used to update relevant lake AUIDs
The Watershed Center Grand Traverse Bay	Yes	E. coli data used for assessment decisions
Three Lakes Association	No	A, Data reviewed, not able to be used for assessment but supported existing assessment decisions based on previous monitoring.

A. Data did not meet minimum requirements for sample size and/or duration
B. Data for parameters not currently used as assessment indicators
C. Data retrieval and manipulation problems

Comment #2:

Section 4.13, [Delisting Category 5 Assessment Units 4.13], EPA guidance recommends that considerations used for delisting waterbodies or impairments should be as stringent as those data and information used to list the waterbody. Therefore, we recommend that the same (or a commensurate) process for listing an impairment should be used for delisting that impairment.

Section 4.8.1.1 [Water Column and Fish tissue Mercury Concentrations], Figure 4.4, at the third decision point (diamond): Is the geometric mean* > 1.8 ng/l+?", use of * and + indicates there are notes associated with this sentence but we were unable to locate the notes. If there are no notes, please remove the note indicators

Section 4.11 [4.11 Assessment Unit Assignment to Categories], Page 26, first full paragraph states: "An assessment unit is considered threatened and is placed in Categories 4 or 5 when water quality data analysis demonstrates a declining trend that is expected to cause that water body to not attain WQS by the next listing cycle (2018)." Should this be changed to 2020? Alternatively, the reference to the date could be removed entirely. (Peter Swenson, USEPA)

EGLE Response:

Recommended edits were made to clarify that the process and data set used to delist impairments will be as, or more, stringent as those used to list. Edits were also made to address comments related to undefined superscripts (deleted) and corrected date references.

9.4 Public Notice of the Draft IR

A draft version of this 2018 IR was made available on EGLE's Web site for public review and comment. This announcement was published on EGLE's calendar between June 28, 2019 and July 29, 2019. Public comments to be considered in the final submittal of the 2018 IR were due July 29, 2019. Seven public comments and one comment from the USEPA were received pertaining to the Draft 2018 IR. EGLE recognizes the importance of public comments and thanks individuals and organizations that provide input, express water quality concerns, or pose questions. Following is a summary of received comments and response. Public and USEPA comments to the Draft Integrated Report are included in their entirety in Appendix E.

Comments #1-#4:

We live in the Flower Creek watershed and I would urge DEGLE to review hydrology report by Dr. Hyndman of MSU and water quality study by Dr. Rediske of GVSU as basis to include Flower Creek as an impaired water body. (similar comments submitted by 4 separate commenters: Frederick Kwant, Michael Graham, Doris Graham, Bruce Froelich)

EGLE Response:

EGLE staff are aware of the recent data collected from the Flower Creek watershed. Because the draft 2018 IR was developed based primarily on review of 2015-2016 data, these more recent studies will be considered during the 2020 IR.

Comment #5:

In reviewing your latest MDEGLE Water Division 2018 report public release/comment work product, and specifically Appendix C (Category 5 impaired waters) and D2 [new listings], I am baffled at not being able to find any of the following:

1. Impairments to the Huron River as to one or more PFAS compounds addressing raw water supply and fish tissue concentrations and perhaps also to water column concentrations.

2. Impairments to the Rogue River as to one or more PFAS compounds, as to total and partial body contact recreation

3. Impairments to Van Etten Lake as to one or more PFAS compounds. as to total and partial body contact recreation.
(Alex Sagady)

EGLE Response:

Because assessments conducted for the 2018 IR were primarily based on reviews of data collected in 2015-2016 (with fish tissue data often a year further back based on processing and analytical timing) the newer data collected relevant to these specific water bodies weren't available. Given the rapid ramp-up of PFAS monitoring in the last couple of years, many of

those data should be available for review and use in assessments during this 2020 IR round, which will primarily focus on data collected in 2017-2018.

Additionally, regarding the assessment of Michigan's Total and Partial Body Contact designated uses using PFAS information; the 2018 IR does not contain a methodology for this kind of assessment. This will be something that is discussed as we move into the 2020 IR process and identify advances to be included in the Assessment Methodology based on newly emerging data and needs.

Comment #6:

The Huron River and many of its tributaries are contaminated with PFAS chemicals. To our knowledge, the Huron River is the only surface waterbody in Michigan that is both used as a drinking water source and is contaminated with PFAS. EGLE's efforts, along with the support of MPART and MDHHS to evaluate the Huron River watershed as a complete entity have been critical to understanding the health risks of PFAS, identifying their sources, and keeping residents of the watershed informed.

The improved understanding of PFAS chemicals, their contamination of fish and surface waters, and the active health advisory to avoid eating fish from the Huron has amounted to considerable concern among river users. Paddlers and anglers continue to express alarm to HRWC about the risks of PFAS exposure through various pathways, primarily fish consumption. Recent communication materials from state agencies warning about the toxicity of river foam have reinforced those concerns.

HRWC realizes there is not currently a numeric PFAS standard for listing the Huron River as impaired or for putting in place a TMDL. We also realize there is not currently a non-numeric, descriptive standard for PFAS such as there is for phosphorus, for example. We do, however, want to emphasize the practical and clearly impaired status of the Huron River due to contamination from PFAS pollutants. We request attention be given to establishing a process for listing as impaired the Huron River or other waterbodies affected by PFAS contamination across the state and will be looking for this in the 2020 Integrated Report.
(Daniel Brown, Huron River Watershed Council)

EGLE Response:

We agree, the development of new assessment methods and the review of newer PFAS data from both the Huron River watershed, and around the state, will be a focus of the 2020 IR process. We understand the concern and look forward to addressing PFAS-related issues in the environment through MPART, but also procedurally through processes such as the biennial assessment of newly collected data undoubtedly leading toward new impairment listings in the future.

It is worth noting, that there currently are aquatic life and drinking water criteria for surface waters for both PFOS (Perfluorooctane sulfonate) and PFOA (Perfluorooctanoic acid), both of which will be considered as assessment methods are developed for relevant data comparisons. We look forward to continued efforts to better reflect emerging issues related to human and ecological health in the 2020 IR, and beyond.

Comment #7:

. . . With that support for protecting water quality in mind, we are concerned about Section 4.7 of the Report, entitled “Lake Erie Support Summary.” In that section, and by reference in Section 3.9, entitled “Designated Use: Public Water Supply,” EGLE makes potentially conflicting statements about its impairment designation of microcystin for drinking water from Lake Erie:

. . . we are concerned the Report will 1) establish inconsistent sampling and water quality standard evaluation compared to sampling and water quality standard evaluation for other toxic substances, and 2) establish a standard potentially unattainable under the currently adopted Domestic Action Plan approved by EGLE and the U.S. EPA for 40 percent phosphorus reduction into Lake Erie by 2025, by setting impairment according to guidance on the most conservative health advisory levels for finished and treated drinking water, rather than water quality of raw source water that has higher productivity and nutrient concentration than the other Great Lakes.

We recommend a reevaluation of the standards under which impairment is determined, which then in turn dictate the water quality standards Lake Erie must attain to be removed from Impaired status, based on the work of the Annex 4 working group and the Lake Erie Domestic Action Plan. These steps are necessary because not only is microcystin’s relationship with water quality more complex than simple calculations of nutrient loading, but also because as referenced in the Report at page 25, nutrient concentrations have a narrative, rather than numeric standard for water quality designation.

Because EPA’s Health Advisory levels for toxic substances are created as non-regulatory guidance and do not include the necessary incorporation of technological and economic feasibility when setting enforceable standards, they may not be an appropriate standard for evaluating Lake Erie water quality standards. We are further concerned that the sampling and criteria established for drinking water under this draft will set up the stakeholders working to manage nutrients with an unachievable standard including continually moving requirements for more and more stringent nutrient reduction goals until the raw source water achieves finished drinking water quality under health advisory guidance and lacking all other technological and economic considerations of meeting drinking water standards.

EGLE Response:

We share your concern in setting appropriate water body goals which, in the case of Lake Erie, acknowledges a uniquely naturally productive system, absent the overabundance of human-related nutrients into the watershed. It is specifically this thinking which led to the following to be included in our Assessment Methodology for the Public Water Supply use (3.9.1.5 Total Microcystins):

”. . . However, the ability to differentiate between possibly naturally occurring occasional total microcystins from those caused or exacerbated by pollutants, differentiates between possible assessments for the PWS use from a surface water standpoint.”

“There are no cyanotoxin water quality criteria for the protection of the public water supply designated use. However, the Public Water Supply designated use may be assessed ***with a combination*** *(emphasis added) of total microcystins monitoring data in raw source water and information on the condition of that water body in the vicinity of the intake related to nutrient inputs and other indications of source water quality issues (e.g. documented blooms of algae or cyanobacteria, observed scums, elevated chlorophyll-a) . . .*

In cases where two or more total microcystins results in surface water exceed the more conservative HA level of 0.3 ug/L in a 3-year period ***and are supported by documented eutrophication and nuisance nutrient conditions*** *(emphasis added) in the same 3-year period (see Section 3.6.2.2) that are likely causative, an assessment of Not Supporting the use may be made. Exceedance of the HA level must be at least 30 days apart to reflect cyanotoxin events that are either repeating frequently, or substantial in duration.*

In rare circumstances, BPJ may be used to assess a water for the Public Water Supply designated use based on different 'weight of evidence' scenarios. However, the presence of total microcystins alone, particularly with limited monitoring data, will typically result in an assessment of Insufficient Information until additional support [exists] linking those concentrations to conditions related to human impacts on the water body. "

Critical to this assessment is the necessity for multiple lines of evidence supporting an impairment determination, specifically BOTH cyanotoxin presence and nuisance nutrient expression. Without continued nuisance conditions related to nutrients, any persistence of cyanotoxin production may indicate a natural condition, or exacerbation by other causes. Until nutrient goals under Annex 4 are achieved, additional causative factors (if they exist and cyanotoxin production remains) are difficult to understand.

EGLE is a full partner in Annex 4 and the development and implementation of the Domestic Action Plan and looks forward to achieving the specific goals of the restoration of ecological balance. The expectation is that the achievement of Annex 4 ecological goals will result in the ability to demonstrate support of the Other Indigenous Aquatic Life and Wildlife use.

We acknowledge that the Public Water Supply use assessment methodology differs between Rule 323.1057 toxics and total microcystins. This difference is not an inconsistency, rather a reflection of the uniquely different ways these toxic parameters may affect human health. The USEPA's Health Advisory levels for total microcystin are based on concerns over short-term exposure (10-days) rather than a lifetime of exposure, as Rule 323.1057 incorporates; it was decided that an approach which compares individual samples to the HA was both reasonably reflective of short-term exposure concerns and protective of human health.

Comment #8:

I went through the spreadsheets that you provided to me (of the MI 2018 IR appendices) and compared them to the spreadsheet that I have from the 2016 303(d) list (Appendix C). I also downloaded the PDF versions of the 2016 and 2018 appendices from you [sic] website and looked up any discrepancies that I found between the two spreadsheet versions. I provide an explanation below that I hope is not too confusing. I can go into more depth and answer questions during our upcoming Skype meeting on July 12th. I only found 48 entries that I could not account for between the two cycles which overall is not an excessive number compared to the size of the lists. . . . This leaves 48 entries that I could not account for between the two

cycles. (James Ruppel, USEPA Region 5)

Summary of findings after looking up missing 2016 Appendix C spreadsheet entries in the downloaded PDF versions of the 2018 Appendices C, D1 and B.		
Note on Spreadsheet Analysis Page	Count	Explanation
Appears to be delisted due to a TMDL but was not included on Appendix D.	14	It appears that 14 of the 2016 entries on Appendix C were intended to be delisted in 2018 due to the completion of a TMDL, but this delisting was not included in either the spreadsheet version or the PDF version of the 2018 Appendix D1.
Appears to be delisted due to WB split but did not show up on spreadsheets provided	4	It appears that 4 of the 2016 entries on Appendix C were delisted in 2018 due to a waterbody assessment unit split, however the delisted entries did not show up on the 2018 Appendix D1 spreadsheets, but do show up on the PDF version of Appendix D1
Duplicate 2016 spreadsheet entry (not a problem)	3	These are duplicate entries in the 2016 spreadsheet and do not present a problem in terms of accounting for 2016 impaired waterbodies overall.
Not Supporting, no TMDL shown in Appendix B, appears like it should be on 2018 list.	4	Based on what I found in the 2018 PDF version of Appendix B, it appears these listing should still be on the 2018 Appendix C
On 2016 but not 2018, not delisted in 2018 nor can I tell from Apndx B what the use support is.	22	There are 22 entries from the 2016 Appendix C that are missing from the 2018 appendices for which I was unable to determine the current status from the 2018 Appendix B
This appears to be a 2018 delisting that did not show up in the spreadsheets provided.	4	There are four 2016 Listings that appear to have been delisted, but did not match up in the 2018 spreadsheets provided.
Triplicate 2016 spreadsheet entry (not a problem)	2	These are triplicate entries in the 2016 spreadsheet and do not present a problem in terms of accounting for 2016 impaired waterbodies overall.

EGLE Response:

All 48 entries were reviewed, discussed with USEPA via phone conference call, and summarized as to actions taken, or clarifications made. (see Appendix E for summary of actions).

Comment #9:

Additional comments and communications between EGLE and USEPA Region 5 staff were focused on ensuring that data were accurately migrated from the formerly used Assessment Database (ADB) into the new Assessment, Total Maximum Daily Load Tracking and Implementation System (ATTAINS). Discussions resulted in resolution of errors (either historic or resulting from the data migration) discovered during those reviews. Primarily the data clean-up needs could be placed into the following broad issue categories:

- Correcting the association of various AUIDs to previously approved TMDLs; ensuring that waters approved for inclusion in specific TMDLs are properly associated with those TMDL action ID's in ATTAINS
- Upload support information for historic 4B assessed waters (see Appendix E for a table with this support information)
- The request by USEPA to provide Appendices in the Final IR that are relatively consistent regarding the information provided so that comparisons can be made more cleanly between the 2016 IR and the 2018 IR (this will not be a need in future IR cycles because previous versions, and comparisons between them, will be achievable in ATTAINS).

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